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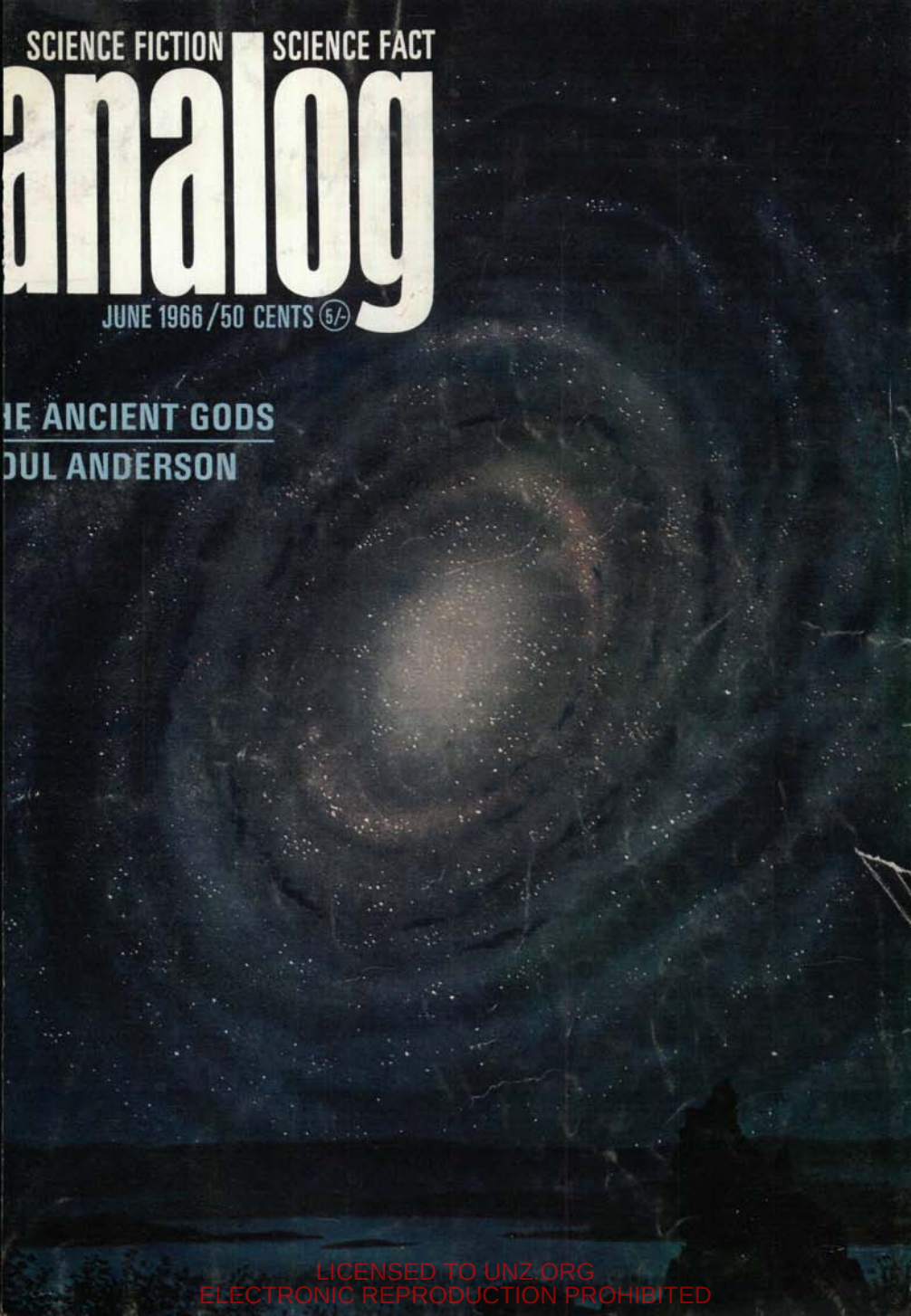
HE ANCIENT GODS

OUL ANDERSON



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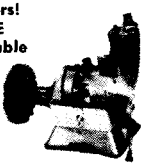

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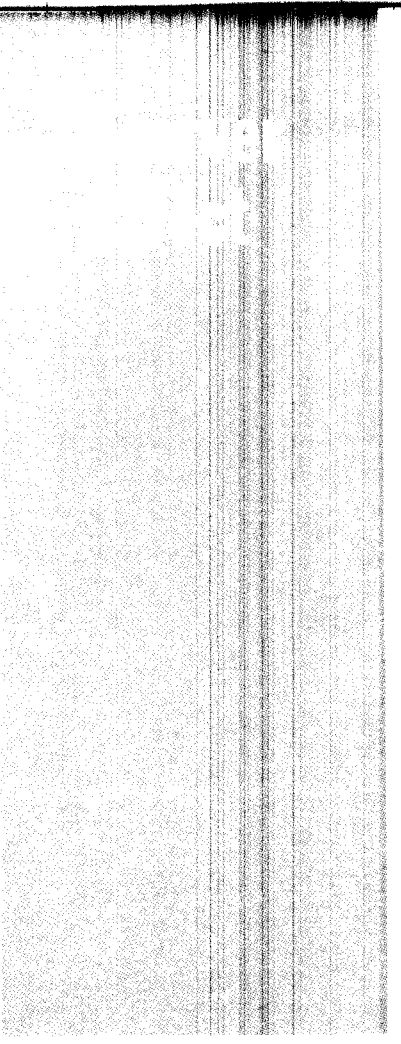
Editorial by
John W. Campbell

The simplest example of the "observer effect" is to consider a blind man trying to feel the size of a soap bubble. He is not going to have much success, because the act of observation destroys that which he wants to observe.

The physicist runs into the same "observer effect" problem when he tries to observe precisely where an electron is. To observe an entity as small as an electron, he must use very high-energy, extremely short wave-length radiation—X rays. Unfortunately X-ray photons of the necessary energy level are about as massive as electrons. The result is that the act of observing can only tell you where the electron *was;* after being slugged with that X-ray quantum, it isn't there any more.

The psychologist has his own version of the problem. Give a man a particular psychological test—and he will, naturally, remember the test. Therefore, the experiment isn't repeatable—making the test changed the characteristics of the entity being observed.



Again and again, as we work with more and more subtle, or shorter-duration, or higher-speed problems, we run into what seems a willful, whimsical, arbitrary, deliberately obfuscating frustration. The effort to observe turns out to destroy the would-be-observed. The Heisenberg Uncertainty Principle seems to be one specialized case of

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the You-Can't-Find-Out Principle.

Try measuring something as simple as the frequency and voltage output of a radio-frequency oscillator. Of course a very special type of voltmeter must be used; a standard AC voltmeter will read zero if attached—because the voltage *will* be zero, with that great clumsy contraption attached. The blind man's trying to feel the soap bubbles again.

So we use a very special type of voltmeter, and get a voltage reading. Of course, attaching the voltmeter adds distributed capacity to the oscillating circuit, so the frequency is changed, and since the circuit contains frequency-sensitive elements, its performance is disturbed. Therefore, the voltage isn't what it would be when you weren't trying to read it.

There are, of course, a million instances of observer effect phenomena known in science. You can't do any really accurate measurement of objects yourself—your body radiates too much heat, and will cause expansion of the object you seek to measure. Attaching a thermocouple to measure temperature imposes additional thermal inertia, and the current generated by the thermocouple, of course, consumes some of the heat-energy you seek to measure.

Oh, certainly—you can measure the temperature of the engine-head in a five hundred horsepower Diesel with a thermocouple. Things that gross don't cause much trouble of the observer-effect type. But suppose you want to measure the temperature of a transistor dot on a microminiaturized circuit—the kind you have to study through a microscope?

The first phenomenon men encounter when they start working in any new, subtle area of Reality is an amazing degree of innate perversity, whimsical cantankerousness, and sheer randomness.

If you think radio engineers had an easy time figuring out all the insane misbehaviors they encountered—guess again! Nasty little tricks turn up, like the discovery that the radio-frequency energy wouldn't go through a piece of pure copper. (RF currents insist on going on the *surface* of a conductor, even if that means they have to go ten inches across the top surface, down two inches along the side, up the inside, and then ten inches across the bottom to get back where they were, but one sixteenth of an inch lower down. That little trick has led many a radio ham to tear his hair trying to figure out why his amplifiers oscillated and his oscillators didn't.)

Things behave in the most obviously irrational manner. Even simple things that just ought to make sense don't. Every freshman chemist knows that iron dissolves rapidly in sulfuric acid, and that lead doesn't. By the time he's a chemical engineer, he ships pure sulfuric acid

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in iron tanks, which can stand it, and keeps it away from lead, which dissolves in it rapidly. (But *don't* rinse out that iron tank with water; the water will dissolve holes in it.)

Albertus Magnus, circa 1250 A.D., reported in his learned book of magical arts, on the magical properties of stones, herbs, and animals. And one of his recipes told "How To Summon a Raine Bowe." The magical feat is performed by taking "the stone called Iris, which is white, like a Chryshtal, and hath hornes or cornors, and put it in the beames of the Sonne. And you shall discover the Raine Bowe upon the Wall."

Give the old boy credit! He was four hundred years ahead of Newton.

The problem in opening any new field is the magnificent opportunities for getting hold of the wrong idea, and going in the wrong direction, whereupon unlimited obfuscations, willful perversities and general chaos manifest themselves. The more subtle the field being studied, the more opportunities for gremlins, imps, and full-fledged Daemons. For alchemists who puttered and mixed and stewed such things as oil of vitriol, aqua regia, aqua fortis, various mineral and organic acids, salts, esters, and extracts, far and away the easiest explosive to make is not gunpowder, but nitroglycerin. To get that you mix nitric and sulfuric acid with glycerin.

And that, no doubt, is what the alchemists meant by "summoning a Daemon too powerful to control." It takes more than a pentagram to control trinitroglycerol!

Currently, psychologists and parapsychologists are working with the most subtle area human beings have yet discovered—the effort to get some sort of understanding of Subjectivity. Why does this man hold this clearly irrational concept so stubbornly, despite all his experience? What is the nature of thought? What is creativity?

As of now, psychology is about as feeble a science as the alchemy of Newton's day. (And Newton was a great alchemical experimenter, as well as everything else he did.) Modern psychology is dealing with what appears to be an area of willful cantankerousness, deliberate perversity, and absolute randomness. They keep insisting that no laws apply to all human beings—which, if true, means that they insist their field is not, and inherently can never be, a science, because there can be only history, not organized knowledge, if there are no laws that apply to all minds.

Actually, we are at the border of an area where the Observer Effect is as powerful a factor as it is in atomic physics, while it is further complicated by the fact that statistical methods can't be used, as they

continued on page 157

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THE ANCIENT GODS

POUL ANDERSON

Part I of II. It was a very strange world—a planet where evolution was fantastically slowed, for there were no stars in its skies, no cosmic radiation to excite mutations, and a race with a history measured in gigayears!

Illustrated by John Schoenherr

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God was rising in the west, and this time the sun was down—only lately, a few clouds were still red above the eastern treetops, against purple dusk; but over the hours that light had waned, until it was little more than an echo of what now swung above Lake Silence—so that His pale glory stood clear to be adored.

The Pack could not all make worship. They had met on a ridge near the lairs and howled when the fingers of God's foremost arm glimmered into view. But He would take long to mount so high that His entire self was revealed. The hes must hunt, the shes wreak, the youngs gather, lest God's Coursers perish. Moreover and worse, the whole Pack unmoving here, so distant from their hills, could draw the notice of a downdevil out of the sea depths; and night or no, the downdevil might then send a war fleet of the Herd; if, indeed, that which had lately arrived in fire and thunder was not enemy work itself. Ya-Kela, the One, had brought some bold followers who would go with him to see about that. But first he stood his watch of homage on behalf of the whole folk.

Slowly, slowly, God climbed into heaven. Ya-Kela crouched on the back of Crooked Rock and sang. He sang the Welcome, and the Praise, and the Strength. Then the last coals of sunset went out, and the sky was empty of everything save God, the angels, and three planets, and God cast a white glade from the world's edge, down the width of Lake Silence until it was lost among the reeds at this shore. The night was still and cool. A breeze gusted, smelling of damp; a fish leaped in a single clear splash, a wing cried its lonely note, reeds rustled and were answered by the inland brush; but otherwise ya-Kela and God had darkness to themselves.

He stopped a while to rest and eat. He was hoarse, the rock was harsh beneath his webs and tail, and weariness dragged at him. Yes, he thought, I grow old. But I am yet the One of the Pack.

A distant boom made him start. Drums? It was not impossible for the Herd to come raiding by night. But it was rare. The downdevils feared God and so their worshipers did, too.

He looked west again, and was astonished to see God's body flame in sight. Why, I must have dozed, he thought in dismay. Does that mean anything other than that I am in truth old? Hastily he went through the invocations and gestures he had missed, until he was caught up. The legends haunted him about creatures that had long ago come from the sky and returned—to Herd day or Pack night, who knew save God and the downdevils? Were these unknown newcomers at Balefire Head, whom he must presently seek out, the same ones? More than ever, the world needed shielding against strangeness. "I call to Thee, we call to Thee, Thou Who casteth

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out the sun, arise, arise, arise . . ."

On another evening, very far away, I had heard another song. This happened when I got back to City.

Like most who colonize a planet, the settlers of Landomar wanted nature and elbow room. There is no other good reason for planting yourself at the bottom of a gravity well. The reason is not quite logical —after all, most of us can satisfy our ape instincts with an occasional groundside visit somewhere, or just with a multisense tape—but I suppose that a gene complex still crops up occasionally which makes the owner want to belong to a specific patch of earth. So if you can find a habitable uninhabited world—statistically rare, but consider how many stars the universe holds—you go with a band of like-minded people to claim it. I don't know whether breeding then reinforces the instinct, or the original parents remain culturally dominant over the centuries. In all events, after a while you have a scattered population which doesn't want outsiders building a starport.

At the same time, starports are necessary. Theoretically they shouldn't be, when any point in space is as close as any other point. In practice, though, an expanding race needs them. First, you have to make up energy differentials between one system and the next in stages. That's obvious enough in the case of the really remote galaxies; we could get there, but we couldn't match a relative velocity which is a goodly fraction of *c*. However, just the variation between, say, the inner and outer part of a spiral arm is a bit too fuel-consuming to overcome in a single jump.

Then second, you need a base for observation, so you can establish precisely where your next goal is and how fast it's moving. And third, of course, you want docks, yards, supply depots. Those could be built anywhere, but since the advanced bases are required for the first two reasons, they soon serve the third function also. And the fourth: rest, recreation, a place to roister and brag and ease off. For this purpose, even a spaceman born is happiest when the environment isn't entirely artificial.

They were more reasonable on Landomar than on some worlds I could name. They wouldn't let us build on the ground, but they made no objection to an orbital satellite. We could go down to their villages and farmsteads, hunt in their forests, sail on their oceans. They didn't mind our money in the least. Then, as City got bigger, with more and more to offer, their young folk started coming to us, to visit, eventually to work. The elders grumbled, until we brought in sociodynamicists to extrapolate the trend for them and prove that it would never really affect their own timeless oneness with the planet. At most, a

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cluster of small space-oriented service enterprises would develop groundside. Which is what happened.

I had spent several days there, arranging for stores, isotopes, and so forth. I also hoped to recruit a gunner. But in that I'd failed. Those few who applied had no aptitude. Well, there was a man, a hunter by trade; but the psychograph showed that he enjoyed killing too much. I felt a little tired and depressed. It didn't help, either, that Wenli was ill. Nothing serious, but the kid would doubtless be adult when I returned, and I like to remember my offspring as happy while they're small.

So I was eager to leave dust behind. My boat hit sky with a yell. Landomar became a giant cloud-banded shield, soft blue against the black. Before long City hove in view.

You can't add randomly to a satellite, or the spin properties would get ridiculous. But City had existed for a few centuries now, and grown in a way that the Landomar elders would not admit was organic. I remembered the original cheerless metal shell. Today I saw towers rocketing from parapets, domes and ports glowing brighter than stars, the Ramakan memorial rakish across galactic clouds; I could see ships in dock and boats aswarm; and as nearly as almost any spaceman—except Hugh Valland—ever does, I felt I was home.

I cycled through the lockfield faster than was strictly safe and did no more than tell the mechmen to check out an irregularity which had registered in the boat pilot's gamma rhythm. At once, wreck all formality, I was out of the dock area and its crowds, along the ramps and through the halls toward Lute's place.

She lives in high-weight, overlooking space itself. That's expensive, but her husbands can afford to pay their share. Not that she picks them on any such basis—not Lute—it's only that a handsome, intelligent woman attracts able men. She's probably my favorite port-wife.

So I hurried down the last corridor. It was empty at the moment. My feet thudded on the floor, which gave me a springier response than Landomar's overrated lawns, and the ventilators seemed to purr louder than usual. The color patterns in the walls happened to be grays and greens, and that was right, too; they fitted with the touch of sadness, homesickness-in-advance, which, of course, counterpointed my pleasure in getting back.

The music did likewise; so much so that I was almost on top of it before it registered on me. An omnisonor was being played, uncommonly well. The tune was archaic, paced like sea tides, but with ringing chords below; and then a man's voice joined in, quite softly.

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"Mary O'Meara, the stars and the dewfall have covered your hilltop with light.

The wind in the lilies that blossom around you goes bearin' your name from the height.

My girl, you are all of the night."

I rounded the hall's curve about the satellite and saw him. He lounged in a bay close to Lute's door. The broad port framed him in darkness and a crescent moon. His fingers ran casually over the keys of the instrument in his lap, his eyes were half closed and he was singing to himself.

"A ship out of shadow bears homeward by starlight, by stars and the loom of your hill.

A hand at a brow is uplifted in peerin', salutin' and shakin' with chill.

My dear, are you waitin' there still?"

In a pause for breath, he noticed me. Something I did not understand went out of his face, to be replaced by a friendly grin. "Hello," he said. His accent had an odd lilt. "Sorry about the racket."

"Enjoyable, sir," I answered formally.

"I was passin' the time," he said, "waitin' for Captain Argens."

"Myself." I bowed.

He unsprawled his height, which was considerable, and thrust out a muscular hand. Archaic for certain! But I made the clasp, and took that moment to study him.

His dress was conventional, blue tunic, white breeks, flexible half-boots. The comets of a Master's rating glowed on his wide shoulders. But the physical type was one that you don't see often: fair skin over craggy features, close-cropped yellow hair, fire-blue eyes. "Hugh Valland," he said, "off the *Lady Lara*."

"Felip Argens," I responded, mechanically in my startlement. I'm old enough to recognize that anyone bearing a name like his must be a great deal older.

"Hear you're lookin' for a gunner," he said.

"Well . . . yes." That was no surprise. Gossip flies fast when more than one ship is in port. "You're interested?"

"Yes, sir, I am. The *Lady*'s inbound again, so her skipper don't mind lettin' me off my contract. Understand you're goin' to Earth."

"Eventually," I nodded. "Might be some time, though."

"That's all right. Just so we get there."

I made a fast computation. If this man had served on the *Lady* he'd have a record and shipmates to consult—much better than a psychograph. Though he already looked good.

"Fine, let's talk," I said. "But, uh, why didn't you wait in the apartment? My wife would have been glad—"

"Hear tell she's got a sick kid. Didn't know if she'd want to play hostess." I liked him better and better.

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The door dilated for me and Lute met us. "How's Wenli?" I asked after presentations.

"Fretful," she said. "Fever. I had her down to the clinic and they confirmed it's a neovirus."

Nothing to be alarmed about, oh, no, not with supportive treatment. But when a thing that was extraterrestrial to start with mutates, the biotechs in a frontier post like City don't have the equipment to tailor a quick-cure molecule. In twenty years or so, having reached optimum adulthood, Wenli would get her antithanatic; thereafter her cells would instantly reject any hostile nucleic acids. But for now my little girl must rely on what poor defenses nature had provided. Recovery would be slow.

She was asleep. I peeked in at the flushed round face, then went back to the others. Valland was jollying Lute with an anecdote from his latest voyage. They'd needed to gain prestige in a culture which rated poetics as the highest art, so he'd introduced the limerick. Watching her laugh, I felt a twinge of jealousy. Not personal; Lute is so thoroughly decent that it isn't even awkward when two of her men happen to be in port at the same time. No, I only wished I had Valland's gift of blarney.

Yet when we invited him to dinner, he accepted with a courtliness you rarely see any more.

He and I went onto the porch for cocktails while Lute programmed the food mechs. Space dropped dizzily from the viewport, thinly starred black here on the rim. Huge and shapeless—we being still more or less within it—the galaxy streamed past and was lost to sight; we looked toward remoteness.

"I need a gunner in case of trouble," I told him. "We'll be dealing with a technologically advanced race, one that we know almost nothing about. But, of course, we don't really expect a fight, so we want a man who can double as second-deck officer. If he has some xenological skill to boot, that's ideal."

"I think I can claim the whole lot," he answered. "No formal trainin'. By the time they got around to foundin' academies in those subjects, I'd already been in space for quite a spell. But you can check me out with the people aboard *Lady Lara,* and on a psychograph, too, if you want."

Luck seemed to have fluxed in my direction. Unless— "You may change your mind when you know where the *Meteor*'s bound," I warned him. "Or do you?"

"No. Just that it's a pretty long hop, and you'll call at Earth afterward. Otherwise none of your gang has blabbed." He chuckled. "Reckon you'd rather not have competition in the early stages of contact, when the cream's at its most skimmable."

"I'll have to tell you, though, and trust you as a Guild brother. We're going to some Yonderfolk."

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"Eh?" He started gratifyingly. "Beyond this galaxy? Like M 31?"

"No," I said. "Not that far. Though where we're bound, we'll be much lonelier. Intergalactic space."

Valland settled back, crossed his legs and twirled his glass between calloused fingers. I offered him a cigarillo, but he declined in favor of a pipe from his tunic—another archaism. Having lit up, I explained:

"There are stars between the galaxies, you know. Dim red dwarfs, so widely separated that this neighborhood looks crowded by comparison; nevertheless, stars. Hitherto no one's thought it worthwhile to investigate them in any detail. Not when we'll take millions of years learning about this one Milky Way of our own, let alone its sisters. But lately . . . some of the intergalactics have made contact with us. They might be worth trading with, goods or knowledge or both. We're going out to have a look. If anything develops, we'll stay for a few years to get the business established."

"I see." He blew a slow cloud. "Sounds interestin'. But after that, you'll head for Earth?"

"Yes. A universarium there is one of the *Meteor*'s co-owners, and wants a direct report." I shrugged. "Science is still alive on Earth, if nothing else."

"More'n that," he murmured. "Earth'll always be Manhome."

"Look here," I asked bluntly, "if you're so anxious to go back, why not get a ticket?"

"No hurry." His affability was unruffled. "I'd've done so in time, if need be. I've done it before. But passage across an energy gap like that isn't cheap. Might's well get paid for makin' the trip."

I didn't press him. That's no way to get to know a man. And I had to know my crew, so that we wouldn't break under the years of otherness.

Lute had arranged a good dinner. We were enjoying it, talking the usual things—whatever became of old Jarud, did you hear what happened on Claw, now once I met the damnedest nonhuman society you ever, let me warn you from bitter experience against gambling with the Stonks, is it true they've made a machine that—when Wenli came in. She was trying not to cry.

"Daddy!" she begged of me. "I got bad dreams in my head."

"Better start the hypnopulser, Lute," I muttered as I picked up the slight form. Having operated out of City enough consecutive years to know as well as beget the child, I hurt at her pain.

My wife half rose. " 'Scuse me, mistress," Valland said. "Don't you think best we chase the dreams off for good before we put her to sleep?"

She looked doubtful. "I been around a while," Valland said apologetically. "Not a father myself, but you can't help pilin' up observa-

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tions. C'mere, little lady." He held out his arms and I passed Wenli to him.

He set her on his lap and leaned back from the table, letting the plate keep his food warm. "All right, my friend," he said, "what kind of dreams?"

She was at a shy stage of life, but to him she explained about blobby monsters that wanted to sit on her. "Well, now," he said, "I know a person who can take care of that. Let's ask him to come give a hand."

"Who?" Her eyes got quite round.

"Fellow name of Thor. He has a red beard, and he drives in a wagon pulled by goats—goats are animals with horns and long *long* whiskers —and the wheels make thunder. You ever heard thunder? Sounds like a boat takin' off in a terrible hurry. And Thor has a hammer, too, which he throws at trolls. I don't think those blobby characters will stand a chance."

I started to open my mouth. This didn't look semantically right to me. Lute laid a warning hand on mine. Following her gaze, I saw that Wenli had stopped shivering.

"Will Thor come if we ask?" she breathed.

"Oh, yes," Valland said. "He owes me a favor. I helped him out once when he got into an argument with an electrostatic generator. Now let me tell you more about him."

Afterward I learned that the tall tale he went on to relate came from Earth, in days so old that even the books are forgetting. But Wenli crowed and clapped her hands when Thor caught the snake that girdles the world. Lute laughed. So did I.

Finally Valland carried Wenli back to bed, fetched his omnisonor, and sang to her. The ballad was likewise ancient—his translation—but it bounced right along, and before he had finished cataloguing the improbable things that should be done to the drunken sailor, my daughter was asleep with no machine needed.

We came back to the fresher room. "Sorry to poke in like that," Valland said. "Maybe you should've curbed me."

"No." Lute's eyes glowed. "I've never seen anyone do anything better."

"Thanks. I'm a childish type myself, so—Hoy, meant to tell you before, this is one gorgeous piece of steak."

We went on to brandy and soda. Valland's capacity was epical. I suppose Lute and I were rather drunk toward the end, though we wouldn't have regretted it next day if our idea had been workable. We exchanged a glance, she nodded, and we offered our guest our total hospitality.

He hadn't shown much effect of alcohol, beyond merriment. Yet now he actually blushed. "No," he said. "Thanks a million, but I got me a

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berth in dock country. Better get down there."

Lute wasn't quite pleased. She has her human share of vanity. He saw that, too. Rising, he took her hand and bowed above it.

"You see," he explained with great gentleness, "I'm from way back. The antithanatic was developed in my lifetime . . . yes, that long ago; I shipped on the first starcraft. So I have medieval habits. What other people do, fine, that's their business. But I've only got one girl, and she's on Earth."

"Oh," Lute said. "Haven't you been gone from her for quite a time, then?"

He smiled. "Sure have. Why do you think I want to return?"

"I don't understand why you left in the first place."

Valland took no offense. "Earth's no place for a live man to live any more. Fine for Mary, not for me. It's not unfair to either of us. We get together often enough, considerin' that we'll never grow old. Between whiles, I can remember . . . But goodnight now, and thanks again."

His attitude still seemed peculiar to me. I'd have to check most carefully with his present captain. You can't take an unbalanced man out between the galaxies.

On the other hand, we're each a bit eccentric, one way or another. That goes along with being immortal. Sometimes we're a bit crazy, even. We don't have the heart to edit certain things out of our memories, and so they grow in the psyche till we no longer have a sense of proportion about them. Like my own case—but no matter.

One thing we have all gained in our centuries is patience. Could be that Hugh Valland simply had a bit more than most.

We were nine aboard the *Meteor*, specialists whose skills overlapped. That was not many, to rattle around in so huge a hull. But you need room and privacy on a long trip, and, of course, as a rule we hauled a lot of cargo.

"Probably not this time, however," I explained to Valland and Yo Rorn. They were the only ones who hadn't shipped with me before; I'd hastily recruited them at Landomar when two vacancies developed for reasons that aren't relevant here. To make up the delay, I hadn't briefed them in detail before we started. But now I must. They'd need days of study to master what little we knew about our goal.

We sat in my com chamber, we three, with coffee and smokes. A steady one G of acceleration gave weight, and that soft engine-pulse which goes on and on until finally it enters your bones. A viewscreen showed us Landomar's sun, already dwindled, and the galaxy filling half the sky with clots and sprawls of glow. That was to starboard; the vector we wanted to build up ran almost parallel to the rim. Portward

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yawned emptiness, here and there the dim spindles of other stellar continents.

"M-m, yeh, don't look like we could find a lot of useful stuff on a planet where they breathe hydrogen and drink liquid ammonia," Valland nodded. "I never did, anyway."

"Then why are we going?" Rorn asked. He was a lean, dark, saturnine man who kept to himself, hadn't so much as told us where in the cosmos he was born. His psychograph indicated a tightly checked instability. But the readings also said he was a good electronician, and he had recommendations from past service. He stubbed out his cigarette and lit another. "Someone from a similar planet would be logical to deal with the . . . what did you say their name was?"

"I can't pronounce it either," I replied. "Let's just call them Yonderfolk."

Rorn scowled. "That could mean any extragalactic race."

"We know what we mean," said Valland mildly. "Ever meet the natives of Carstor's Planet?"

"Heard of them," I said. "Tall, thin, very ancient culture, unbearably dignified. Right?"

"Uh-huh. When I was there, we called 'em Squidgies."

"Business, please," Rorn barked.

"Very well," I said. "What we hope to get from our Yonderfolk is, mainly, knowledge—insights, ideas, art forms, possibly something new in physics or chemistry or some other science. You never can tell. If nothing else, they know about the intergalactic stars, so maybe they can steer us onto planets that will be profitable for humans. In fact, judging from what they've revealed so far, there's one such planet right in their home system."

Valland looked for a while into the blackness to port. "They must be different from anybody we've met before," he murmured. "We can't imagine how different."

"Right," I said. "Consider what that could mean in terms of what they know."

I cleared my throat. "Brace yourself, Yo," said Valland. "The Old Man's shiftin' into lecture gear." Rorn looked blank, then resentful. I didn't mind.

"Theory, first," I said. "Let's quickly review how there could be intergalactic systems at all.

"The galaxies were formed by the condensation of monstrous hydrogen clouds. But there wasn't an absolute vacuum between them. Especially not in the beginning, when the universe hadn't yet expanded very far. So between the proto-galaxies there must have been smaller condensations of gas, which became star clusters. Giant stars in those clusters soon went supernova, enriching the interstellar medium. Some second and third generation suns got born.

"But then the clusters broke up. Gravitational effect of the galaxies, you see. The dispersal of matter be-

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came too great for star formation to go on. The bright ones burned themselves out. But the red dwarfs are still around. A type M, for instance, stays fifty billion years on the main sequence."

"Please," Rorn said, irritated. "Valland and I do know elementary astrophysics." To the gunner: "Don't you?"

"But I begin to see what it means," Valland said low. Excitement coursed over his face. He clenched his pipe in one fist. "Stars so far apart that you can't find one from another without a big telescope. Metal poor, because the supernova enrichment stopped early. And old—old."

"Right," I said. "Planets, too. Almost without iron or copper or uranium, anything that made it so easy for us to become industrialized. But the lighter elements exist. So does life. So does intelligence.

"I don't know how those Yonderfolk we're going to visit went beyond the Stone Age. That's one of the things we have to find out. I can guess. They could experiment with electrostatics, with voltaic piles, with ceramics. Finally they could get to the point of electrodynamics . . . oh, let's say by using ceramic tubes filled with electrolytic solution for conductors. And so, finally, they'd extract light metals like aluminum and magnesium from ores. But they may have needed millions of years of civilization to get that far, and beyond."

"What'd they learn along the way?" Valland wondered. "Yeh, I see why we've got to go there."

"Even after they developed the space jump, they steered clear of the galaxies," I said. "They can't take the radiation. Where they live, there are no natural radioactives worth mentioning, except perhaps a few things like K-40. Their sun doesn't spit out many charged particles. There's no galactic magnetic field to accelerate cosmic rays. No supernovae either."

"Why, maybe they have natural immortality," Valland suggested.

"M-m, I doubt that," I said. "True, we're saddled with more radiation. But ordinary quantum processes will mutate cells, too, or viruses, or chemicals, or Q factor, or—or whatever else they may have on Yonder."

"Have they developed an antithanatic, then?" Rorn asked.

"I don't know," I said. "If not, that's one valuable thing we have to offer. I hope."

I saw in the brief twist of Valland's mouth that he understood me. Spacemen don't talk about it much, but there are races, as intelligent and as able to suffer as we ourselves, for whom nobody has figured out an aging preventive. The job is hard enough in most cases: develop a synthetic virus which, rather than attacking normal cells, destroys any that do not quite conform to the host's genetic code. When the biochemistry is too dif-

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ferent from what we know—Mostly, we leave such planets alone.

I said in haste: "But let's keep to facts. The Yonderfolk did at last venture to the galactic rim, with heavy radiation screening. It happened that the first world they came on which was in contact with our civilization, was Zara. Our own company had a factor there."

We didn't yet know how many suns they visited first. Our one galaxy holds more than a hundred billion, most of which have attendants. I doubt if we'll ever see them all. There could be any number of civilizations as great as ours, that close to home, unbeknownst to us. Yet we go hopping off to Andromeda!

(I made that remark to Hugh Valland, later in the voyage. "Sure," he said. "Always happens that way. The Spanish were settlin' the Philippines before they knew the coastal outline of America. People were on the moon before they'd got to the Mindanao Deep." At the time I didn't quite follow him, but since then I've read a little about the history of Manhome.)

"Zara." Rorn frowned. "I don't quite place—"

"Why should you?" Valland replied. "More planets around than you could shake a stick at. Though I really can't see why anybody'd want to shake a stick at a planet that never did him any harm."

"It's the same type as the Yonderfolk's home," I said. "Zara, that is. Cold, hydrogen-helium atmosphere, et cetera. They made contact with our factor because he was sitting in the only obviously machine-culture complex on the surface. They went through the usual linguistic problems, and finally got to conversing. Here's a picture."

I activated my projector and rotated the image of a being. It was no more inhuman than many who had been my friends: squat, scaly, head like a complicated sponge; one of several hands carried something which sparkled.

"Actually," I said, "the language barrier was higher than ordinary. To be expected, no doubt, when they came from such an alien environment. So we haven't a lot of information, and a good deal of what we do have must be garbled. Still, we're reasonably sure they aren't foolish enough to be hostile, and do want to develop this new relationship. Within the galaxy, they're badly handicapped by having to stay behind their rad screens. So they asked us to come to them. Our factor notified the company, the company's interested . . . and that, sirs, is why we're here."

"M-m. They gave location data for their home system?" Valland asked.

"Apparently so," I said. "Space coordinates, velocity vector, orbital elements and data for each planet of the star."

"Must've been hard, transforming from their math to ours."

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"Probably. The factor's report gives few details, so I can't be sure. He was in too big a hurry to notify headquarters and send the Yonderfolk back—before the competition heard about them. But he promised we'd soon dispatch an expedition. That's us."

"A private company, instead of an official delegation?" Rorn bridled.

"Oh, come off it," Valland said. "Exactly which government out of a million would you choose to act? This is too big a cosmos for anything but individuals to deal with it."

"There'll be others," I said fast. A certain amount of argument on a cruise is good, passes the time and keeps men alert; but you have to head off the kind which can fester. "We couldn't keep the secret for long, even if we wanted to. Meanwhile, we do represent the Universarium of Nordamerik, as well as a commercial interest.

"Now, here are the tapes and data sheets—"

The ship drove outward.

We had a large relative velocity to match. The days crawled past, and Landomar's sun shrank to a star, and still you couldn't see any change in the galaxy. Once we'd shaken down, we had little to do; the mechs operated everything for us. We talked, read, exercised, pursued our various hobbies, threw small parties. Most of us had lived a sufficient number of years in space so we didn't mind the monotony. It's only external, anyhow. After a century or three of life, you have plenty to think about, and a cruise is a good opportunity.

I fretted a little over Yo Rorn. He was always so glum, and apt to be a bit nasty when he spoke. Still, nothing serious developed.

Enver Smeth, our chemist, gave me some concern, too. He was barely thirty years old, and had spent twenty-five of them on Arwy, which is a bucolic patriarchal settlement like Landomar, under the warm wing of his parents. Then he broke free and went to the space academy on Iron—but that's another tight little existence. I was his first captain and this was his first really long trip. You have to start sometime, though, and he was shaping up well.

Very soon he became Hugh Valland's worshiper. I could see why. Here the boy encountered a big, gusty, tough but good-natured man who'd been everywhere and done everything—and was close to three thousand years old, could speak of nations on Manhome that are like a myth to the rest of us, had shipped with none less than Janosek—and to top the deal off, was the kind of balladeer that Smeth only dreamed of being. Valland took the situation well, refrained from exploiting or patronizing, and managed to slip him bits of sound advice.

Then came the Captain's Brawl.

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In twenty-four hours we would be making the jump. You can't help feeling a certain tension. The custom is good, that the crew have a final blast where almost anything goes.

We ate a gourmet dinner, and made the traditional toasts, and settled down to serious drinking. After a while the saloon roared. Alen Galmer, Chu Bren, Galt Urduga, and, yes, Yo Rorn crouched over a flying pair of dice in one corner. The rest of us stamped out a hooraw dance on the deck, Valland giving us the measure with ringing omnisonor and bawdy words, until the sweat rivered across our skins and even that mummy-ancient line, "Why the deuce aren't you a beautiful woman?" became funny once more.

"So let's hope other ladies
Are just as kind as Alixy,
For, spaceman, it's your duty
To populate the galaxy!"

"Yow-ee!" we shouted, grabbed for our glasses, drank deep and breathed hard.

Smeth flung himself onto the same bench as Valland. "Never heard that song before," he panted.

"You will," Valland drawled. "An oldtimer." He paused. "To tell the truth, I made it up myself, 'bout five hundred years back."

"I never knew that," I said. "I believe you, though."

"Sure." Smeth attempted a worldly grin. "With the experience you must've had in those lines by now. Eh, Hugh?"

"Uh . . . well—" The humor departed from Valland. He emptied his goblet with a sudden, almost violent gesture.

Smeth was in a lickerish mood. "Womanizing memories, that's the kind you never edit out," he said.

Valland got up and poured himself a refill.

I recalled that episode at Lute's, and decided I'd better divert the lad from my gunner. "As a matter of fact," I said, "those are among the most dispensable ones you'll have."

"You're joking!" Smeth protested.

"I am not," I said. "The really fine times, the girls you've really cared for, yes, of course you'll keep those. But after a thousand casual romps, the thousand and first is nothing special."

"How about that, Hugh?" Smeth called. "You're the oldest man aboard. Maybe the oldest man alive. What do you say?"

Valland shrugged and returned to us. "The skipper's right," he answered shortly. He sat down and stared at what we couldn't see.

I had to talk lest there be trouble, and wasn't able to think of anything but banalities. "Look, Enver," I told Smeth, "it isn't possible to carry around every experience you'll accumulate in, oh, just a century or two. You'd swamp in the mass of data. It'd be the kind of insanity that there's no cure for. So, every once in a while, you go

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under the machine, and concentrate on the blocks of memory you've decided you can do without, and those particular RNA molecules are neutralized. But, if you aren't careful, you'll make big, personality-destroying gaps. You have to preserve the overall pattern of your past, and the important details. At the same time, you have to be ruthless with some things, or you can saddle yourself with the damnedest complexes. So you do *not* keep trivia. And you do not overemphasize any one type of experience, idea, or what have you. Understand?"

"Maybe," Smeth grumbled. "I think I'll go join the dice game."

Valland continued to sit by himself, drinking hard. I wondered about him. Being a little tired and muzzy, I stayed on the same bench. Abruptly he shook his big frame, leaned over toward me, and said, low under the racket:

"No, Skipper, I'm neither impotent nor homosexual. Matter's very simple. I fell in love once for all, when I was young. And she loves me. We're enough for each other. We don't want more. You see?"

He hadn't shown it before, but he was plainly pretty drunk. "I suppose I see," I told him with care. "Wouldn't be honest to claim I feel what you mean."

"Reckon you don't," he said. "Between them, immortality and star travel changed everything. Not necessarily for the worse. I pass no judgments on anybody." He pondered. "Could be," he said, "if I'd stayed on Earth, Mary and I would've grown apart, too. Could be. But this wanderin' keeps me, well, fresh. Then I come home and tell her everything that happened."

He picked up his omnisonor again, strummed a few bars, and murmured those lyrics I had heard when first we met.

"I'll sing me a song about Mary O'Meara, with stars like a crown in her hair.
Sing of her memory rangin' before me whatever the ways that I fare.
My joy is to know she is there."

Well, I thought with startling originality, it takes all kinds.

We were ready to jump.

Every system was tuned, every observation and computation finished, every man at his post. I went to the bridge, strapped myself into recoil harness, and watched the clock. Exact timing isn't too important, as far as a ship is concerned; the position error caused by a few minutes' leeway is small compared to the usual error in your figures. But for psychological reasons you'd better stay on schedule. Pushing that button is the loneliest thing a man can do.

I had no premonitions. But it grew almighty quiet in my helmet as I waited. The very act of suiting up reminds you that something

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could go wrong; that something did go wrong for others you once knew; that our immortality isn't absolute, because sooner or later some chance combination of circumstances is bound to kill you.

What a spaceship captain fears most, as he watches the clock by himself on the bridge, is arriving in the same place as a solid body. Then atoms jam together and the ship goes out in a nuclear explosion. But that's a stupid fear, really. You set your dials for emergence at a goodly distance from the target sun, well off the ecliptic plane. The probability of a rock being just there, just then, is vanishingly small. In point of fact, I told myself, this trip we'd be in an ideal spot. We wouldn't even get the slight radiation dosage that's normal—scarcely any hydrogen for our atoms to interact with, between the galaxies.

Nevertheless, we were going two hundred and thirty thousand light-years away.

And I do not understand the principle of the space jump. Oh, I've studied the math. I can recite the popular version as glibly as the next man: "Astronomers showed that gravitational forces, being weak and propagating at light velocity, were insufficient to account for the cohesion of the universe. A new theory then postulated that space has an intrinsic unity, that every point is equivalent to every other point. One location is distinguished from another only by the n-dimensional coordinates of the mass which is present there. These coordinates describe a configuration of the matter-energy field which can be altered artificially. When this is done, the mass, in effect, makes an instantaneous transition to the corresponding other point in space. Energy being conserved, the mass retains the momentum—with respect to the general background of the galaxies—that it had prior to this transition, plus or minus an amount corresponding to the difference in gravitational potential."

It sounds like magic to me.

But a lot of things seem magical. There are primitives who believe that by eating somebody they can acquire that person's virtue. Well, you can train an animal, kill it, extract the RNA from its brain, put this into another animal, and the second beast will exhibit behavior characteristic of that same training.

The clock showed Minute One. I cut the drive. We ran free, weight departed, silence clamped down on me like a hand.

I stared out at the chaotic beauty which flamed to starboard. So long, galaxy, I thought. I'll be seeing you again, in your entirety; only what I'll see is you as you were a quarter of a million years ago.

The time reeled toward Minute Two. I unfastened the safety lock and laid my gloved finger on the red button.

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Nothing came over the comsystem into my ear plugs. We were each without words.

Time.

The shock was too horrible. I couldn't react.

No blackness, with the great spiral for background and a wan red star glowing before us. A planet filled the screen.

I saw the vision grow, kilometers per second. hurtling upon us or we upon it. Half was dark, half was mottled with landscape, agleam with waters, under a blood-colored day. No chance to reset the jump unit and escape, no chance to do anything but gape into the face of Death. A roaring filled my helmet. It was my own voice.

Then Hugh Valland's tone cut through, "Pilots! Reverse us and *blast*!"

That jarred me loose from my stupor. I looked at the degree scale etched in the screen and the numbers on the radar meters, I made an estimate of vectors and ripped out my commands. The engine boomed. The planet swept around my head. Acceleration stuffed me down into my harness and sat on my chest. Unconsciousness passed in rags before my eyes.

We had too much velocity to kill in what time remained. But we got rid of some of it, in those few minutes before we struck atmosphere; and we didn't flash directly down, we entered at a low angle.

With such speed, we skipped, as a stone is skipped across a river. Shock after shock slammed into us. Metal shrieked. The viewscreens filled with incandescence. This ungainly hulk of a vessel was never meant to land. She was supposed to lie in orbit while our two ferries served her. But now she had to come down!

Somehow, Bren and Galmer operated the pilot board. Somehow they kept the drive going, resisting our plunge, bringing us groundward in a fury that only sufficed to boil away our outer plates. When the main drive was ruined and quit, they used the steering units. When those went out, one by one, they used what was left. Finally nothing remained and we fell. But then we were so low, our speed so checked, that a man had some chance.

I heard the bellowings, the protest and the breaking of steel. I felt the furnace heat from the inner bulkheads, through and through my spacesuit until lips cracked open and nasal passages were tubes of anguish. I saw the water below, and braced myself, and remembered I must not. Relax, float free, let harness and suit and flesh absorb the shock.

We hit.

I crawled back to awareness. My mouth was full of blood, which had smeared my faceplate so that it was hard to see out. One eye, being swollen shut, didn't help. Hammers

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beat on every cell of me, and my left arm wouldn't respond. I thought in a dull, vague way: My skull can't really be split open . . .

The men!

Nothing sounded except my own rattling breath. But surely, I cried, this was because the comsystem had been knocked out. Got to go see. Got to unstrap and find my men.

I didn't set my teeth against the pain of movement. That would have taken more control than I had, in my present state. I whimpered through the many minutes of fumbling. At last I slid free, onto the canted, buckled deck. I lay there a while before being able to get up and feel my way aft.

The ship was dead. No screens functioned, no ventilators whispered, no lights glowed except the evershine panels spotted along the corridors. By their dim greenishness I stumbled and slipped, calling out names.

After some part of eternity a human shape met me in the passage. Not quite human, a two-legged bulk with a grotesque glassy head; but the radio voice was Hugh Valland's. "That you, Skipper?" I clung to him and sobbed.

"We're lucky," he told me. "I've been lookin' us over. If we'd crashed in a sea we'd be done. The whole after section's flooded. We've sunk. But the nose seems to be pokin' out into air."

"How are the others?" I asked.

"Can't find anyone in the engine compartment," he said grimly. "I took a flash and went into the water, but no trace, just a big half-melted hole in the side. They must've been carried out with the main reactor. So there're two gone." (Let me record their names here, Morn Krisnan and Roli Blax, good men.) Valland sighed. "Don't seem like young Smeth'll last long either."

Seven men, I thought, in poor shape, wrecked on a planet that every probability says is lethal for them.

"I came through fairly well, myself," Valland went on. "Suppose you join the rest. They're in the saloon. I want to gander out of a lock. I'll report to you."

The room where we met was a cave. One evershine, knocked out of its frame, had been brought in for light. It threw huge misshapen shadows across crumpled walls. Snags of girders protruded like stalactites. The men slumped in their armor. I called the roll: Bren, Galmer, Urduga, Rorn. And Smeth, of course. He hadn't left us yet.

He was even conscious, more or less. They had laid him out on a bench as well as might be. I peered into his helmet. The skin looked green in what light we had, and the blood that bubbled from his mouth was black. But the eyeballs showed very white. I tuned up his radio for

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him and heard the harsh liquidity of his breathing.

Rorn joined me. "He's done," he said without tone. "His harness ripped loose from the stanchions when they gave way where he was, and he got tossed against a bulkhead. So his ribs are stove through his lungs and the spine's broken."

"How do you know?" I challenged. "His suit's intact, isn't it?"

Teeth gleamed in the murk that was Rorn's face. "Captain," he said, "I helped carry the boy here. We got him to describe how he felt, when he woke, and try to move his arms and legs. Look at him."

"Mother, mother," said the gurgle in my ear plugs.

Valland came back. "The ferryboats are smashed, too," he said. "Their housin's took the main impact. We won't be leavin' this planet soon."

"What's outside?" I asked.

"We're in a lake. Can't see the opposite edge. But the water's fairly shallow where we are, and there's a shore about two kilometers off. We can raft to land."

"For what?" Rorn fleered.

"Well," Valland said, "I saw some aquatic animals jump. So there's life. Presumably our kind of life, proteins in water solution, though of course I don't expect we could eat it."

He stood a while, brooding in gloom, before he continued: "I think I can guess what happened. You remember the Yonderfolk said their system included a planet in the liquid-water thermal zone. The innermost one, with a mass and density such that surface gravity ought to be two-thirds Earth standard. Which feels about right, eh?"

Only then did I notice. Every motion had hurt so much that nothing except pain registered. But, yes, I was lighter than before. Maybe that was the reason I could keep my feet.

"The Yonderfolk gave us information on each planet of this star," Valland went on. "I don't know exactly who made the big mistake. There was that language problem; and the factor on Zara was in a hurry to boot. So my guess is, the Yonderfolk misunderstood him. They thought we wanted to land here first, it bein' more comfortable for us; they even thought we had the means to land directly. So they supplied figures and formulas for doin' just that. And we assumed they were tellin' us how to find a nice, safe, convenient point way off from the sun, and cranked the wrong stuff into our computer."

He spread his hands. "I could be wrong," he said. "Maybe the factor's to blame. Maybe some curdbrain in the home office is. Fact remains, though, doesn't it, that you don't blindly jump toward a point in space; because you have to allow for your target star movin'. You use a formula. We got the wrong one."

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"What do we do about it?" Rorn snapped.

"We survive," Valland said.

"Oh? When we don't even know if the air is breathable? We could light a fire, sure, and test for oxygen. How about other gases? Spores or—Argh!" Rorn turned his back.

"There is that," Valland admitted.

He swung about and stared down at Smeth. "We have to unsuit him anyway, to see if we've got a chance to help him," he said finally. "And we haven't got time . . . he hasn't . . . for riggin' an Earth-

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atmosphere compartment. So—"

He bent onto one knee, his faceplate close to the boy's. "Enver," he said gently. "You hear me?"

"Yes . . . yes . . . oh, it hurts —" I could scarcely endure listening.

Valland took Smeth's hand. "Can I remove your suit?" he asked.

"I've only had thirty years," Smeth shrieked. "Thirty miserable years! You've had three thousand!"

"Shut up." Valland's tone stayed soft, but I've heard less crack in a bullwhip. "You're a man, aren't you?"

Smeth gasped for seconds before he replied, "Go ahead, Hugh."

Valland got Urduga to help. They took the broken body out of its suit, with as much care as its mother would have given. They fetched cloths and sponged off the blood and bandaged the holes. Smeth did not die till three hours later.

At home, anywhere in civilization—perhaps aboard this ship, if the ship had not been a ruin—we might have saved him. We didn't have a tissue regenerator, but we did have surgical and chemical apparatus. With what we could find in the wreckage, we tried. The memory of our trying is one that I plan to wipe out.

Finally Smeth asked Valland to sing to him. By then we were all unsuited. The air was thin, hot and damp, full of strange odors, and you could hear the lake chuckle in the submerged compartments. Valland got his omnisonor, which had come through unscathed while our biogenic stimulator shattered. "What would you like to hear?" he asked.

"I like . . . that tune . . . about your girl at home."

Valland hesitated barely long enough for me to notice. Then: "Sure," he said. "Such as it is."

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I crouched in the crazily tilted and twisted chamber, in shadows, and listened.

"The song shall ride home on the surf of the starlight and leap to the shores of the sky,

Take wing on the wind and the odor of lilies and Mary O'Meara-ward fly,

And whisper your name where you lie."

He got no further than that stanza before Smeth's eyes rolled back and went blind.

We sank the body and prepared to leave. During the past hours, men who were not otherwise occupied had taken inventory and busied themselves. We still had many tools, some weapons, clothes, medicines, abundant freeze-dried rations, a knockdown shelter, any number of useful oddments. Most important, our food unit was intact. That was no coincidence. Not expecting to use it at once on Yonder, nor at all if our stay wasn't prolonged, we had stowed it in the recoil-mounted midsection. With the help of torches run off the capacitors, as long as they lasted, the work gang assembled a pontoon raft. We could ferry our things ashore.

"We'll live," Hugh Valland said.

I gazed out of the lock, across the waters. The sun was low but rising, a huge red ember, one degree and nineteen minutes across, so dull that you could look straight into it. The sky was deep purple. The land lay in eternal twilight, barely visible to human eyes at this distance, an upward-humping blackness against the crimson sheen on the lake. A flight of creatures with leathery wings croaked hoarsely as they passed above us. The air was dank and tropical. Now that my broken arm was stadered, I could use it, but those nerves throbbed.

"I'm not sure I want to," I muttered.

Valland spoke a brisk obscenity. "What's a few years? Shouldn't take us any longer to find some way off this hellball."

I goggled at him. "Do you seriously believe we can?

He lifted his tawny head with so much arrogance that he wasn't even aware of it, and answered: "Sure. Got to. Mary O'Meara's waitin' for me."

The sun crept down almost too slowly to notice. We had days of daylight. But because the night would be similarly long and very dark, we exhausted ourselves getting camp established.

Our site was a small headland, jutting a few meters above the shore and thus fairly dry. Inland the country ran toward a range of low hills. They were covered with trees whose broad leaves were an autumnal riot of bronzes and yellows, as far as we could identify color in this sullen illumination. The same hues prevailed in those

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tussocky growths which seemed to correspond to grass, on the open stretch between woods and water, and in the reedy plants along the mud beach. But this was not due to any fall season; the planet had little axial tilt. Photosynthesis under a red dwarf star can't use chlorophyl.

We saw a good deal of wild life; and though the thin air deadened sound, we heard much more, off in the swamps to the north. But having only the chemical apparatus left to make a few primitive tests —which did show certain amino acids, vitamins, and so forth missing, as you'd expect—we never ventured to eat local stuff. Instead we lived off packaged supplies until our food plant was producing.

To get that far was our most heartbreaking job. In theory it's quite simple. You fit together your wide, flat tanks, with their pumps and irradiator coils; you sterilize them, fill them with distilled water, add the necessary organics and minerals; you put in your cultures, filter the air intake, seal off the whole thing against environmental contamination, and sit back. Both phyto- and zooplankton multiply explosively till equilibrium is reached. They are gene-tailored to contain, between them, every essential of human nutrition. As needed, you pump out several kilos at a time, return the water, cook, flavor, and eat. (Or you can dispense with flavors if you must: the natural taste is rather like shrimp.) You pass your own wastes back through a processor into the tank so that more plankton can grow. The cycle isn't one hundred percent efficient, of course, but comes surprisingly close. A good construction only needs a few kilos of supplementary material per year, and we had salvaged enough for a century, blessing the Guild law that every spaceship must be equipped fail-safe.

Simple. Sure. When there are machines to do the heavy work, and machines to control quality, and it isn't raining half the time, and you're acclimated to air and temperature, and your nerves aren't stretched wire-thin with looking for the menaces that instinct says must lurk all around, and you don't keep wondering what's the use of the whole dismal struggle. *We* had to assemble a small nuclear generator to supply current, and level a site for the tanks with hand shovels, and put up our shelter and a stockade, and learn about the planet faster than it could find new ways to kill us, simultaneously.

About hazards: No carnivores attacked. A few times we glimpsed web-footed arctoid giants. They kept their distance; doubtless we smelled inedible to them and doubtless we were. But a horned thing, thrice the mass of a human, charged from the brush at Rorn and Galmer as they went survey-

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ing. They gave it the full blast of two heavy torchguns, and it didn't die and didn't die, it kept on coming till it collapsed a meter away, and then as they left, it crawled after them for a long while. Bren almost drowned in a mudhole. The ground was full of them, concealed by plants growing on their surfaces. Urduga came near a sort of vine, which grabbed him. The sucker mouths couldn't break his skin, but he couldn't get loose either. I had to chop him free; naturally we never left camp alone. Though we had portable radios and gyrocompasses, we dreaded losing our way in these featureless marshlands. From time to time we noticed bipedal forms skulk in the distant bush. They disappeared before we could bring optical aids to bear, but Galmer insisted he had glimpsed a spear carried by one of them. And without the main reactor, the ship's heavy weapons were inert. We had a few sidearms, nothing else.

Microbes we simply had to risk. We should be immune to all viruses, and odds were that no native bacteria or protozoa could make headway in our systems either. But you never knew for certain, and sometimes you lay awake wondering if the ache in your body was only weariness. Until we got our hut assembled, endless dim day and frequent rains made sleep hard to come by.

In spite of strain, or perhaps because of it, no quarrels flapped up at first—except once, when I told Bren and Galmer to make measurements. I wanted precise values for gravity, air pressure, humidity, magnetism, ionization, horizon distance, rotation period, solar spectrum lines, whatever could be found with a battery of instruments from the ship.

"Why now?" Rorn demanded. He was no more gaunt and dirty than the rest of us, as we sat in our shelter while another storm drummed on the roof. "We've hardly begun the heavy work like building a stockade."

"Information-gathering is just as urgent," I answered. "The sooner we know what kind of place we're in, the sooner we can lay plans that make sense."

"Why those two men, though?" Rorn's mouth twisted uncontrollably. We hadn't yet installed lights, and the single flash hanging overhead cast his eyes into thick shadow, as if already a skull looked at me. "We can take turns. Easy to sit and twiddle with a pendulum and clock."

"Well," Bren said mildly, "that sounds fair."

"Veto," I said. "You boys are trained in navigation and planetography. You can do the job quicker and better than anyone else."

"Besides," Valland pointed out, "they won't sit continuously. Between sun shots, for instance, we'll put 'em to somethin' real hard." He grinned. "Like maybe findin' some

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way to make plankton imitate steak."

"Don't remind me!" Rorn grated. "Aren't we miserable enough?"

"What do you propose to do about our troubles?" I asked sharply. A gust of wind made the thin metal walls shake around us.

"What do *you?* How do we get off of here?"

"The most obvious way," Urduga said, "is to fix a radio transmitter that can beam to Yonder."

"If they use radio," Rorn countered. "We don't any more, except for special things like spacesuits. Why shouldn't they space-jump electron patterns? Then they'll never detect our signal—if you actually can build an interplanetary 'caster with your bare hands!"

"Oh, we got tools and parts," Valland said. "Or maybe we can fix one of the ferries. Got to take a close look into that possibility. Simmer down, Yo. Once I get a home brewery rigged, we'll all feel better."

"If you don't want to work with us, Rorn," Urduga added, "you have the freedom of this planet."

"None of that!" I exclaimed. "Once we turn on each other, we're done. How about a song, Hugh?"

"Well, if you can stand it." Valland got his omnisonor and launched into another ballad he had translated from old times on Earth. No doubt it should have been something decorous about home and mother, or something heroically defiant. But our ragged, hungry, sweaty crew got more out of "The Bastard King of England." Rorn alone didn't laugh and join in the choruses; however, he kept his despair quiet.

Over a period of standard days, Bren and Galmer accumulated quite a bit of information. Though the red sun was still aloft, their photoscreen 'scope could pick out other galaxies for astronomical reference points. Their laser-beam transit and oscilloscope could accurately measure that sun's creep down the sky. In calm weather they had a flat western horizon, out where the lake ran beyond vision. The short year enabled them to take a good sample of our orbit. And so on and so on. When added to what little the Yonderfolk had reported—they'd visited this world in the past, but were really no more interested in it than Earthmen in Sol I—and to general scientific principles, these data enabled us to make a fairly good sketch.

We were in the middle northern latitudes of a planet which had a diameter three percent greater than Earth's. The size was no cause for astonishment. Dim stars haven't enough radiation pressure to inhibit such masses from condensing close to them out of the original dust cloud. Nor were we surprised that weight was only 0.655 standard. The very old systems, formed

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in early generations, have little in the way of heavy elements like iron. This planet lacked a metallic core, must, in fact, be sima clear to the center. Hence the low mean specific gravity and the absence of a magnetic field.

Nor did it own any satellites. Solar gravitation had served to prevent that. This force had also, over billions of years, slowed rotation until one hemisphere faced inward. Then tides in water and atmosphere continued to act, until now the globe had a slow retrograde rotation. Combined with a sidereal year of ninety-four and a half Earth-days, this spin gave us a diurnal period of forty-four Earth-days on the surface—three weeks of light, three weeks of dark.

Coreless, the planet had no vertical tectonic and orogenic forces worth mentioning. Once the mountains formed by surface distortion had eroded away, no new ones got built. Nor were there great ocean basins. We were lucky to have come down by this wet land; we'd not likely find anything much better anywhere, and most of the world must be submerged.

Though the total irradiation received was only slightly less than what Earth gets, it lay heavily in the red and infrared. The sun's wavelength of maximum emission was, in fact, about 6,600 angstroms, near the end of the human-visible spectrum. This accounted for the steamy heat we lived with. Scarcely any ultraviolet light was given off, and none of that penetrated to us; we needed artificial irradiation as much as our plankton did. Nor does a red dwarf spit out many energetic charged particles. Accordingly, while the planet was ancient indeed—fifteen billion years a conservative guess—it still had plenty of water, and an atmosphere corresponding at sea level to a medium-high terrestrial mountaintop.

Given air, a hydrosphere, and an infrared oven in the sky, you don't have to have actinic radiation—what we would call actinic, I mean—for nature's primeval chemicals to become life. It simply takes longer. As we had noted, since we could breathe, there were photosynthetic plants. They probably utilized one of the low-level enzyme-chain processes which have been observed in similar cases within the galaxies. Likewise the animals. In spite of having less energetic biochemistries than us, they seemed to be just about as active. Shooting and dissecting some we found elaborate multiple hearts and huge, convoluted lungs, as well as organs whose purposes we couldn't guess. Evolution eventually produces all possible capabilities.

Including intelligence. The sun was touching the lake's rim when Urduga shouted us to him. From camp nobody could make out our ship very well, except through goggles. Those were uncomfortable to wear in this climate. Besides, the

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cells that powered their infrared conversion and photon multiplication wouldn't last forever. So we left them off as much as possible. Now we slapped them on and stared out at the upward-thrusting nose of the *Meteor*.

There, in a fiery shimmer across the water, were four canoes. Long lean shapes with high prows, they were manned by a good dozen creatures apiece. We could barely see, against that sun-dazzle, that the crews were a little under human size, bipeds, powerfully legged and tailed. We launched our raft and paddled toward them, but they hastened off. Before long they had vanished into dusk.

I, who have met thousands of different races, still feel that each new one is a new epoch. Stars, planets, biological systems fall into categories; minds do not, and you never know what strangeness will confront you. Though this first glimpse of the Herd had so little result, I hate to tell of it casually.

But you can imagine what talking we did afterward in camp.

This evening the galaxy rose directly after sunset. In spite of its angular diameter, twenty-two degrees along the major axis, our unaided eyes saw it ghostly pale across seventy thousand parsecs. By day it would be invisible. Except for what supergiants we could see as tiny sparks within it, we had no stars at night, and little of that permanent aurora which gives the planets of more active suns a skyglow. There was some zodiacal light, but that was scant help. We must depend on fluorescents, flashes, fire, and goggles to carry on our work.

But then that work reached a crisis point. The generator was operating, the plankton tanks breeding food, the camp snugged down within a stockade of sharpened logs. We'd continue indefinitely manufacturing small comforts and conveniences for ourselves. But the question could no longer be shoved aside: What were we going to do to break free?

Would we? I knew the result if we didn't. When our teeth wore down to the gums, and no biogenic apparatus was on hand to stimulate regrowth, we could make dental plates. When monotony got unendurable, we could build or explore or otherwise occupy ourselves. But when at length there were too many unedited memory bits, we would gradually lose our reason.

Sleep evaded me. The shelter was hot and stank of man. The other cots crowded in on mine. Bren snored. My arm was healing with the speed of immortal flesh and bone, but on occasion still pained me. Finally I rose and walked outside.

The yard lights were off. No use inviting attention during a rest period. Between hut and stockade lay a well of blackness, relieved

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only by a bluish watery glow where irradiator coils energized our plankton. A wind boomed softly, warm and dank, full of swamp musks; the generator whirred in its shell; distantly came a beast's hoot; lake water lapped among those rustling plants we called reeds.

And I heard another sound, Valland's omnisonor. He was on watch. Tonight he didn't sing, he stroked forth lilting notes that spoke of peace. I groped my way to the crude skeleton tower on which he sat, light switches and a gun ready to hand.

He sensed me. "Who's there?" he called.

"Me. Mind if I come join you for a little?"

"No. Glad of company. Sentry-squat gets a mite lonesome."

I climbed up and sat on the platform's bench beside him. Since I hadn't taken my goggles, he was no more than another big shadow. The sky was clear, except for a few thin clouds reflecting the galaxy's glow. It sheened on the lake, too; but shoreward, night drank down its light and I was blind.

Vast and beautiful, it had barely cleared the horizon, which made it seem yet more huge. I could just trace out the arms, curling from a lambent nucleus . . . yes, there was the coil whence man had come, though if I could see man by these photons he would still be a naked half-ape running the forests of Earth. Otherwise I was only able to see three glitters which we now knew were planets.

"What was that tune you were playing?" I asked.

"Somethin' by Carl Nielsen. Doubt if you've heard of him. He was a composer on Earth, before my time, but popular yet when I was young."

"After three millennia, you still remember such details?" I wondered.

"Well, I keep goin' back there, you know, on account of Mary," Valland said. "And Earth doesn't change much any more. So I get reminded. My later memories are the ones I can dispense with."

I realized that this must be the reason he, with his abilities, was not commanding a ship. That would have had him star-hopping at somebody else's orders. I didn't know when I'd see Lute and Wenli again, for instance, if I got back into space. The company rotated personnel among home stations, so fifty years was an entirely possible gap. Valland must return home a good deal oftener.

"She seems to be quite a girl, yours," I said.

"Oh, yes," he whispered into the wind.

"You're married?"

"No official contract." Valland laughed. "Plain to see, Skipper, you're post-exodus. Mary'd follow the old custom and take my name if—" He broke off.

"You know," I said, for I wanted

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to speak of such things in this foreign night, "you've never shown us her picture. And everybody else practically carries an album of his women around with him."

"I don't need any stereo animation," he said curtly. "Got a better one in my head." Relaxing, he laughed once more. "Besides, she said once—this was when breeks had hip pockets—it didn't seem like a very sentimental gesture, carryin' her picture next to my," he paused, "heart."

"You've got me curious, though. Dog my hatch for me if I'm prying, but what does she look like?"

"Shucks, I'm only too glad to talk about her. Trouble is, words're such feeble little quacks. That's why I made me a song. Adapted from an old Swedish one, to be honest."

"Swedish? I don't recall any planet named Swede."

"No, no, Sweden, Sverige, a country, back when Earth had countries. Nice people there, if a bit broody. I'm part Swede myself."

Valland fell silent. The galaxy glimmered so coldly above the lake that I had to say something. "What about Mary?"

"Oh." He started. "Yes. That. Well, she's tall, and has a sort of rangy walk, and words just won't fit her."

"Well, I'd like to meet the lady," I said, "if we reach Earth."

"We will," Valland answered. "Somehow." His arm rose, pointing, a massive bar across the clouds. "That planet there, orange color. Must be Yonder. We don't need to go any farther than that."

"Two hundred and thirty thousand light-years in no time," I said bitterly, "and a few million kilometers are too much for us."

"Well, it's a big universe," he said. "We don't shrink it any by crossin' it."

After a moment he added: "We can make Yonder, though. The more I think and look at what's available to us, the more I'm convinced that between two wrecked ferries and parts of a wrecked ship, we can put together one sound vessel. No use wishin' we could do anything with the space-jump apparatus. That's so much scrap, and we'd never fix it even if we knew how. So we won't be sendin' the Yonderfolk any signals that way."

"Frankly, I'm skeptical about our chances of simply building an interplanetary maser," I confessed.

"Oh, we'll do that, kind of incidentally," Valland said. "Same as we'll make conspicuous marks in the territory around here, in case somebody comes flyin' by. But Yo was right, a while back. They aren't likely to have the right kind of radio receivers on Yonder. And as for a rescue party, well, at best it'll be an almighty long time before anybody figures out what could've happened to us, and I'll make book that nobody does. Not with so

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scanty and confused a record to go on.

"So . . . I figure our sole decent chance is to flit to Yonder in person. We needn't build a very fancy spaceboat, you realize. A one-man job for a one-way trip, with no special radiation screenin' required. I've checked. Been an engineer myself, several kinds of engineer, now and then, so I know. One power plant is almost intact. Repairman's data in the microfiles aboard ship amount to a complete set of plans, which we can modify for our particular purposes. What machine tools we don't now have, we can repair, or build from scratch.

"Sure, sure, a long, tough job. The precision aspects, like assemblin' control panels or adjustin' drive units, they'll be worse than any sheer labor. But we can do it, given patience."

"Hold on," I objected. "The brute force problem alone is too much for us. Six men can't juggle tons of metal around with their muscles. We'll need cranes and . . . and make your own list. We'll have to start this project down near the bottom of shipyard technology.

"Hugh, we haven't got enough man-years. If we don't go memory-crazy first, we'll still be making bedplates when the supplementary chemicals for the food tanks give out. And I refuse to believe we can do anything about *that*."

"Probably not," Valland admitted. "I never claimed we could start a whole biomolecular industry. But you're overlookin' somethin', Skipper. True, half a dozen men make too small a labor force to build a spaceship, even by cannibalizin', in the time we have. However . . . Hoy!"

He sprang to his feet.

"What is it?" I cried.

"*Sh-h-h.* Somethin' out there. Approachin' real slow and careful. But two-legged, and carryin' things. Let's not scare 'em off." Valland stepped to the ladder and handed me his goggles. "Here, you stay put. Cover me as well as you can, but don't switch on any lights. Our kind of light may well hurt their eyes. I'll kindle a torch to see by. They must know fire."

I stared and stared into murk. Shadow shapes in shadow land. "Looks as if they're armed," I muttered.

"'Course they are. Wouldn't you be? But I doubt they'll slip a pigsticker into me on no provocation." Valland laughed, most softly but like a boy. "You know," he said, "I was just speakin' of the devil, and what came by? A bigger pair of horns than Othello thought he had!"

I didn't follow his mythological references, but his meaning was plain. My own heart jumped inside me.

There is an old game in which you show a picture of a nonhuman to your friends and ask them to de-

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scribe the being. No xenological coordinates allowed; they must use words alone. The inexperienced player always falls back on analogy. Like Valland, simply to be jocular, remarking that the Azkashi resembled web-footed kangaroos, a bit shorter than men, with hands and hairless gray skins, bulldog muzzles, mule ears, and eyes as big as the Round Tower. Which means nothing to that ninety-nine percent of the human race who have never been on Earth and have never heard of animals many of which are extinct anyway.

Myself, I think the game is silly. I'd be satisfied to speak of bipeds adapted to a world mostly swamp and water. I would mention the great yellow eyes, that saw only a short ways into those frequencies we call red and otherwise had to focus infrared waves—largely because they could also see fairly well at night. I might say the beings didn't have nostrils, but closable slits beneath the ears, since this gave their voices an odd snarling quality. The barrel chests were also significant, betokening a metabolism that required more oxygen per breath than we who are blessed with iron-based hemoglobin. It is certainly worth recording that the species was bisexual, viviparous, and homeothermic, though not technically mammalian.

In general, though, I don't care what image you develop. What matters about a people is technology, thought, art, the whole pattern of life.

As for technics, the score of hunters who entered our compound were high-level paleolithic. Their weapons were spears, tomahawks, daggers, and blowguns. Stone, bone, and wood were beautifully worked and tastefully ornamented. They went nude except for a sort of leather harness, which supported a pouch as well as tools and armament. But an older one who seemed to be their leader had a representation of the galaxy tattooed on his head.

We were relieved to find no obviously alien semantics. These people would be much easier to understand than the Yonderfolk—or so we thought. For example, they had individual names, and their gestures were the kind humans would make in attempting sign language. When we fetched gifts, a steel knife for ya-Kela the boss and some bits of plastic and other junk for his followers, they yelped and danced with delight. They had brought presents of their own, local handicrafts, which we accepted with due dignity. There came an embarrassing moment, several hours later, when three Azkashi, who had slipped out into the woods, returned with a big-game animal for us. We were doubtless expected to eat it, and had no idea if it would poison us. But Valland carried the situation off by soaking the body in camp fuel and setting it alight

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on a heap of wood. Our visitors got the idea at once: this was how the strangers who indicated they had come from the galaxy accepted an offering.

"In fact," Valland remarked to me, "they're smart fellows. They must've watched us from the woods for a long time before decidin' to send a delegation. My guess is they waited for the galaxy to rise; it's a god or whatnot to them, and then they felt safer against our *mana*. But now that they're here and know we don't mean any harm, they're tryin' hard for communication."

Ya-Kela was, at least, and so was Valland. Most of the other hunters left after a while, to take word back home. Man and nonman squatted in the compound, by firelight, drew pictures and exchanged gestures. Rorn complained about the darkness outside our hut. I overruled him. "We've seen them cover their eyes against our normal illumination," I said. "We don't want them to go away. They may be our labor force."

"Indeed?" Rorn said. "How'll you pay them?"

"With metal. I don't know how many thousands of knives and saws and planes we can make out of scrap from the ship, and you must have noticed how ya-Kela appreciates the blade we gave him. I saw him holding it up once and singing to it."

"Nice theory. Only . . . Captain, I've dealt with primitives, too. Generally they don't make proper helpers for a civilized man. They don't have the drive, persistence, orderliness, not even the capability of learning."

"Rather like your caveman ancestors, huh, Yo?" Urduga gibed.

Rorn flushed. "All right, call it a culture pattern if you want. It's still real."

"Maybe it isn't in this case," I said. "We'll find out."

With a good bit more hope in me, I started organizing us for work. First we had to jury-rig a better lighting system aboard the *Meteor*, so we could operate effectively. Next, with spacesuits doubling as diving rigs, we must patch most of the holes in the hull, seal off the remaining compartments, pump out the water and float her ashore. Then there'd be the construction of a drydock, or whatever we decided was best. Then we must take a complete inventory, so we'd know exactly what was possible for us to build; and lay concrete plans; and —The list looked infinite. But we had to begin somewhere. By burning torch and electric flare, we rafted out to the wreck.

Valland stayed behind, dealing with ya-Kela. That didn't look very strenuous, and again Rorn protested. "I don't give a belch if it's fair or not," I threw back at him. "Somebody has to spend full time learning the language, and Hugh's got

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more talent for that sort of thing than any two of you clumpfeet put together."

Which was true. With the help of his omnisonor for noises that the human throat would not form, he could soon produce every Azkashi phoneme; and then it was not so much linguistics as a sense of poetry that was needed to fit them into meaningful phrases.

I was not too surprised when, after several Earth-days, he told me that ya-Kela and the others wanted to go home—taking him along. He was eager to make a visit. What could I do but agree?

With a woodsranger's wariness, ya-Kela reserved judgment. Perhaps he had misunderstood those few words and gestures the stranger called ya-Valland could make. Perhaps ya-Valland did not really claim to be the emissary of God.

For surely he had curious weaknesses. He was as night blind as any downdevil once he took off his fish-resembling mask. Without tail or footwebs, he stumbled awkwardly through the marshes; and whenever the party swam across a body of water, he was still more clumsy and soon grew tired. Besides, he must push those things he carried on his back ahead of him, lashed to a log. One could accept that he did not speak the speech of the Pack—God must use a tongue more noble—but he was ignorant of the simplest matters, must actually be restrained from walking into a dart bush. There might be some magical reason for his not touching ordinary food and, instead, opening little packets of powder and mixing them with water to swell the bulk before he cooked himself a meal. But why must he send the water itself steaming through a thing of bottles joined by a tube, rather than lap up a drink on his way?

Ya-Eltokh, one of the four who had remained to accompany them back, growled: "He is weirder than any of the Herd. And that great thing he came in, sitting out in Lake Silence! How sure are you that he is not some downdevil animal sent to trap us?"

"If so, the Herd has been clever," ya-Kela said, "for our watchers told how their canoes fled when the strangers tried to come near. And you know well that prisoners we tortured were made to confess that the downdevils did not appear to have anything to do with that which, generations ago, came from the sky. Why, then, should the enemy have brought this new manifestation about?" He signed the air. "I am the One of the Pack. The thought was mine that we should seek the strangers out, for they might be from God. If I was wrong, it is my soul that will suffer; but with this hand I will plunge the first spear into ya-Valland."

He hoped that would not come to pass. The big ugly creature was so likable in his fashion, and the

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music he made was somehow more important than the sharp blade he had given. He explained, after much fumbling on both sides, that the tune he made most often was a song to his she. But when he heard those notes, little ghosts ran up and down the skin of ya-Kela. There was strong magic in that song.

They continued to seek understanding whenever they camped. Ya-Valland guided the lessons with marvelous skill. By the time they reached the lairs, he could do a little real talking.

It was good to be back in hill country. The Herd fighters seldom ventured into this land of long ridges and darkling valleys, noisy rivers and silent woods. Ya-Kela snuffed a wind that bore the odor of ninla nests, heard the remote scream of a kurakh on the prowl, saw God swirl radiant above Cragdale, and bayed to call his folk. They slipped from dells and thickets until the trail was a stream of lithe, padding hunters, and went together to the caves where the Pack dwelt.

Ya-Kela took ya-Valland into his own place. His aunt, su-Kulka, made the guest welcome and prepared a bed. His she and youngs were frightened and kept in the background, but that was as it should be anyhow. Now ya-Kela settled down to toil with the newcomer as he might have settled down to chasing a onehorn till it dropped. And as God mounted yet higher in heaven, serious talk became possible. It went haltingly, with many misunderstandings; but it went.

The great question was hardest to pose and get answered. Ya-Valland seemed to make an honest effort, but his words contradicted each other. Yes, he was from God. No, he was not of God. Finally he swung to asking questions himself. Ya-Kela replied, in the hope of making himself clear when his turn came again.

"God is the Begetter, the One of the World. All others are less than Him. We pray to God alone, as He has commanded," ya-Kela said, pointing and acting. He returned from the cave mouth and squatted against his tail once more. The fire was big, throwing the painted walls into lurid smoky relief. But it didn't appear to make much light for ya-Valland.

"The downdevils are the enemies of God. They deny Him, as does the Herd which serves them. But we know we are right to course for God—because He does not rule our lives, He asks only worship and upright conduct of us. Furthermore, He lights the night for us, on those times when He is risen after sunset. And then the downdevils can see but poorly." Mutter: "Almost as poorly as you, my friend-?-enemy." Aloud: "Such of the Herd as we have captured when they

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came raiding say the downdevils made the world and rule it. And true, they have powerful things to give. But the price is freedom."

"The Herd people are like you, then?" ya-Valland asked.

"Yes and no. Many of them resemble us, and we have learned over generations that certain Azkashi whom Herd raiders take prisoner are used for breeding stock. But others look most unlike any member of this Pack or any other Pack, and none of them think like us. They are afraid of God, even when the sun is in the sky at the same time to hide Him; and they worship the downdevils."

That much conversation took the entire while between two sleeps. Then ya-Kela must judge disputes among his folk; for he was the One. Meanwhile ya-Valland studied language with su-Kulka, su-Iss, and other wise old shes.

Thus he was better able to explain himself at the following talk: "We fell from the sky, where our own Pack hunts. We cannot return until we have fixed our boat. That will be the work of many years, and cannot be done without many hands. For this we will pay in goods, blades such as we gave you, tools that will lighten your labor, perhaps also teaching of arts you do not know yourselves."

"But how shall the Pack be fed meanwhile?" ya-Kela asked.

"Given the use of certain weapons we own, fewer hunters can bring in ample game. Besides, they will soon drive off those enemies who trouble you."

Now this I may doubt, ya-Kela thought. You showed us your thunderous arms back at your camp. But are they really more potent than the downdevils'? I do not know. Perhaps you do not either.

He said merely, "That is good; yet such is not the ancient way. When you go, and leave a large number of our youngs who have not had time to learn the skills we live by, what then?"

"You're one hell of a bright boy, you know?" said ya-Valland in his own speech. He replied, "We must consider that also. If we plan well, there need be no hungry years; for the tools and weapons you earn will keep you fed until the old ways are learned afresh. Or it is even possible —though this I cannot promise— that my people will wish to come and trade with yours."

He leaned forward, his eyes brilliant in the firelight, the musicmaker in his lap talking sweetly as God Himself. "We must begin in a small way in any case, ya-Kela. Find me only a few clever young hes that are willing to come back with me and work for knives like yours. In a year or so, we will find out if this is good for our two sides."

"Gr-r-um." Ya-Kela rubbed his muzzle thoughtfully. "You utter no ill word there. But let me think on the matter before I say anything to the Pack at large."

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That period, shortly before sleep, ya-Valland spoke into a little box he carried. It answered him, as had often happened before. But this time ya-Kela saw him grow tense, and his voice was chipped sharp and his smell became acrid.

"What is wrong?" asked the One, with hand on knife.

Ya-Valland bit his lip. "I may as well tell you," he said. "I know you still keep watchers, who will send word here as soon as they can reach the drums. Vessels have landed by the camp of my people, and some from the crews have entered the stockade to talk."

"The Herd does not use the language of the Pack," ya-Kela said. Dampness sprang forth on his skin. "Some have learned it, true. But none of your folk save you have mastered any but a few shards of Azkashi. How can there be talk?"

Ya-Valland was silent for a long while. Light from the waning fire picked out the shes and youngs, crouched frightened in the cave.

"I do not know," ya-Valland said. "But best I return at once. Will you give me a guide?"

Ya-Kela sprang to the cave mouth and bayed after help. "You lie!" he snarled. "I can tell that you hold something back. So you shall not leave before we have the entire truth from your downdevil mouth."

Ya-Valland could not have followed every word. But he rose himself, huge and strange, and clasped the weapon that hung at his belt.

We always left one man on the guard tower while the rest were at the ship. What Valland had radioed —good thing our gear included some portables!—suggested that attack by certain rivals of the Azkashi was not unthinkable. He hadn't learned much about them yet, except that they belonged to quite a different culture and must have sent those canoes we spied at sunset.

No doubt the Azkashi were prejudiced. They were . . . well, you couldn't call them simple hunters and gatherers. A Pack was only vaguely equivalent to a human-type tribe; Valland suspected that rather subtler concepts were involved. He was still unsure about so elementary a matter as what "Azkashi" meant. It referred collectively to the different Packs, which shared out the inland hunting grounds and lakeside fishing rights, spoke a common tongue and maintained a common way of life. But should the name be translated "hill people" as he thought at first, or "free people," or "people of the galaxy god," or what? Maybe it meant all those things, and more.

But at any rate, the Shkil, as ya-Kela called them, sometimes preyed on the Azkashi; and in the past, they had driven the Packs out of lands on the far side of Lake Silence. This, and certain other details which Valland got during his struggle for comprehension, suggested a more advanced society, agricultural, spreading at the ex-

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pense of the savages. Which in turn made me wonder if the Shkil might not be potentially more useful to us. On the other hand, they might be hostile, for any of a multitude of reasons. We took no chances. A man in the tower, with gun and searchlights, could hold off an assault and cover the landing of his friends.

By chance, I was the sentry when the Shkil arrived. The galaxy was hidden in a slow, hot rain; my optical equipment could show me nothing beyond the vapors that steamed under our walls. So I must huddle cursing beneath an inadequate roof while they maddened me with snatches of radioed information from the spaceship. Finally, though, the data were clear. A large band of autochthones had appeared in several outsize canoes and a double-hulled galley. They wanted to confer. And . . . at least one of them spoke the Yonderfolk language!

I dared not let myself believe that the Yonderfolk still maintained an outpost on this planet, so useless and lethal to them. But I felt almost dizzy as I agreed that two or three of the newcomers might enter our compound along with the returning work party. And when they came, we left no one on the tower. We settled for barring the gate before we led our guests into the hut.

Then I stood, soaked, hearing the rain rumble on our roof, crowded with my men between these narrow walls, and looked upon wonder.

Our visitors were three. One resembled the Azkashi we had already met, though he wore a white robe of vegetable fiber and a tall white hat, carried a crookheaded staff like some ancient bishop, and need but breathe a syllable for the others to jump at his command. One was a giant, a good two hundred forty centimeters in height. His legs and arms were disproportionately long and powerful, his head small. He wore a corselet of scaly leather and carried a rawhide shield; but at our insistence he had left his weapons behind. The third, by way of contrast, was a dwarf, also robed, but in gray. He kept his eyes shut and I took a while to realize that he was blind.

The one with the staff waved his free hand around quite coolly, as if extraplanetary maroons were an everyday affair. *"Niao,"* he said. I gathered this was his people's name for themselves. He pointed to his own breast. "Gianyi."

"Felip Argens," I said, not to be outdone. I introduced my comrades and summed them up: "Men."

"We've told him that much," Urduga murmured in my ear. "He stood in the prow of that galley and talked for . . . you know how long. But you're better at the Yonder lingo than any of us, Captain."

I ought to be. I'd studied, as well

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as electro-crammed, what little had been learned at Zara. Not that we could be sure the language was what the Yonderfolk used among themselves. It might well be an artificial code, like many others I had met, designed for establishing quick communication with anyone whose mind wasn't hopelessly alien. No matter. Gianyi of the Niao had also mastered it.

"Sit down, everybody," I babbled. "What can we offer them? Better not anything to eat or drink. Presents. Find some good presents, somebody. And for mercy's sake, whiskey!"

We had a little guzzling alcohol left. It steadied me. I forgot the rain and the heat and the darkness outside, bending myself to talk with Gianyi.

That wasn't any light job. Neither of us had a large vocabulary in that language of gestures as well as sounds. What we had in common was still less. Furthermore, his people's acquaintance with it antedated mine by many generations, and had not been reinforced by subsequent contact. You might say he had another dialect. Finally, a language originated by beings unlike his race or mine was now filtered through two different body types and cultural patterns—indeed, through different instincts; I had yet to discover how very different.

So I can no more set down coherent discourse for Gianyi and me than I could for ya-Kela and Valland. I can merely pretend.

"We came from the sky," I said. "We are friendly, but we have been wrecked and need help before we can leave. You have met others, not akin to us but also from the sky, not so?"

"They tell me such beings came," Gianyi said. "It was before my time, and far away."

That made sense. In an early stage of space travel, the Yonderfolk would have visited their neighbor planets. Finding intelligent life here, they would have instituted a base from which to conduct scientific studies—before they discovered the space jump and abandoned this world for ones more interesting and hospitable to them. And it would have been an unlikely coincidence if that base happened to have been anywhere near here.

How, though, had the mutual language been preserved through Earth centuries after they left? And how had it traveled across hundreds or thousands of kilometers to us? I asked Gianyi and got no good answer through the linguistic haze. The Ai Chun could do such things, he tried to explain. The Ai Chun had sent his party to us, making him the commander since he was among those Niao who were traditionally instructed in sky-talk. He bowed his head whenever he spoke that name. So did the blind dwarf. The giant remained motionless, poised, only his eyes never rested.

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"A ruling class," Bren suggested to me. "Theocrats?"

"Maybe," I said. "I have an impression they're something more, though." To Gianyi: "We will be glad to meet the Ai Chun and make gifts to them as well as to the rest of your people."

He got unreasonably excited. I must not lump Niao and Ai Chun together. That was wrong. That was bad medicine. I apologized for my ignorance.

Gianyi calmed down. "You will meet the Ai Chun," he said. "You will come with us to them."

"Well, one or two of us will," I agreed. We had to take some risks.

"No, no. Every one of you. They have so ordered."

Not being sure whether that last term indicated a fiat or simply a request, I tried to explain that we could not abandon our camp. Gianyi barked at the giant, who growled and took a stiff-legged step forward. I heard guns leave their holsters at my back.

"Easy! Easy!" I sprang to my feet. "You want to start a war?" Gianyi rose also and waved his bully boy back. We faced each other, he and I, while the rain came down louder. The dwarf had never stirred.

I cleared my throat. "You must know that those from the sky have great powers," I said. "Or if you do not, the Ai Chun should. We have no wish to fight. We will, however, if you insist we do what is impossible. Have all the Niao come here? Certainly not. Likewise, all of us cannot go away with you. But we will be glad to send one or two, in friendship."

When I had made this clear, which took time, Gianyi turned to the dwarf and spoke a while in his own high-pitched language. Something like pain went across the blind countenance. The answer was almost too low to hear. Gianyi folded his hands and bent nearly to the floor before he straightened and addressed me again.

"So be it," he told me. "We will take a pair of you. We will leave two canoes here to keep watch. The crews can catch fish to live. You are not to molest them."

"What is going on?" Urduga whispered behind me.

I looked at the dwarf, who was now shivering, and made no reply. That poor little thing couldn't be the real chief of the party. Well, I've met different kinds of telepathic sensitives among the million known civilizations; none like him, but—

"Think it's a good idea to go, Captain?" Galmer asked.

"I don't think we have much choice," I told him, trying hard to keep my voice steady. Inside, I was afraid. "We'll be here a long time. We've got to know what we're up against."

"They may mean well in spite of their manners," Bren said.

"Sure," I said. "They may." The

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rain gurgled as it fell onto soaked earth.

While Gianyi and his escort waited impassive, we discussed procedure. Our representatives were to be taken to the opposite shore, where the Niao had a frontier settlement. From Valland's questioning of ya-Kela, we knew the lake was broad, an inland sea. Still, we should get across in a couple of standard days, given those swift-looking boats. We might or might not be able to maintain radio contact. Valland could, but he hadn't traveled so far. Under the tenuous ionosphere of this planet, we needed a hypersensitive receiver to read him.

I must go, having the best command of Yonder. An extra man was desirable, both as a backup for me —the situation looked trickier than Valland's—and as evidence of good faith on our part. Everyone volunteered—who could do otherwise, with the rest of us watching?—and I picked Yo Rorn. He wasn't my ideal of a traveling companion, but his special skills could be duplicated by Valland and Bren working in concert, whereas nobody but Urduga could fix a drive unit and Galmer was alone in knowing the ins and outs of a control system.

We started to pack our gear, more or less what Valland himself had taken along. Bedrolls; plastic tent; cooking and distilling utensils; lyophilized food from stores; medical kit; torchguns and charges; radio, extra capacitors, hand-cranked minigenerator for reviving them; flashes, goggles, photoplates, spare garments— The receiver buzzed. I thrust across the crowded hut and sat down. "Hello?" I shouted.

"Me, here," Valland's voice said, tiny out of the speaker. "Just reportin'. Things look pretty hopeful at this end. How's with you?"

I told him.

He whistled. "Looks like the Herd's found you out."

"The what?"

"The Shkil. You remember. I've about decided it translates best as 'Herd.' What'd you say they call themselves?"

"The Niao. With somebody else in charge that they name as Ai Chun."

"The downdevils, I suppose. My own translation again, of an Azkashi word that means somethin' like 'the evil ones in the depths.' Only I thought the downdevils were a set of pagan gods, as contrasted with the local religion where the galaxy's the one solitary original God, beware of imitations."

Valland's lightness was not matched by his tone. I realized with a jolt that this was putting him in a bad fix. What with the strain of the past hours, trying to unravel Gianyi's intent, we'd forgotten that our shipmate was among people who hated and feared those I was about to depart with.

And . . . surely the Pack had

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watchers by the edge of the wilderness.

"We can hardly avoid going," I said, "but we'll stall till you can return here."

"Well, I'll try. Hang on a bit."

There followed some ugly noises.

"Hugh!" I cried. "Hugh, are you there?"

The rain had stopped, and silence grew thick in the hut. Gianyi muttered through the dwarf to his unknown masters. I sat and quietly cursed.

Finally, breathlessly, Valland said:

"Matters peaked in an awful hurry. Ya-Kela figured treachery. He called in his goons and wanted to put me to the question, as I believe the polite term is. I pointed out that I could shoot my way clear. He said I'd have to sleep eventually and then he'd get me. I said no, I'd start right back to camp if need be, might not make it but I'd sure give him a run for his money. Only look, old pal, I said, let's be reasonable. My people don't know anything about the downdevils. Maybe they've been tricked. If so, I'll want your help to rescue them, and between us we can strike a hefty blow. Or suppose the worst, suppose my people decide to collaborate with the enemy because they offer a better deal. Then I'll be worth more to you as a hostage than a corpse. I got him calmed down. Now he wants to lecture me at length about how bad the downdevils are."

"Try to explain the idea of neutrality," I said. "Uh, Hugh, are you sure you'll be all right?"

"No," he said. "Are you sure for yourself?"

I tried to answer, but my throat tightened up on me.

"We're both in a bad spot," Valland said, "and I wouldn't be surprised but what yours is worse. Ya-Kela swore by his God he won't hurt me as long as I keep my nose clean. I won't be a prisoner, exactly; more like a guest who isn't permitted to leave. I think he'll stand by that. I've already handed him my gun, and still he's lettin' me finish before he sequestrates the radio. So I ought to be safe for the time bein'. You go ahead and sound out the whosits . . . Ai Chun. You've got to. Once you're back, we'll parley."

I tried to imagine what it had been like, standing in a cave full of wolves and surrendering one's only weapon on the strength of a promise. I couldn't.

To be concluded

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EARLY WARNING

The question that always haunts a Commander-in-Chief must be "Is our national security really secure? Can I trust our warning systems?" There is one way he might find out . . .

ROBIN S. SCOTT

Stan Robinson

Early Warning

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Lee Coulson was a big man, big in the chest and long legged, and it was difficult for him to squeeze his bulk into the narrow space under the green ducter. The ducter, with the telephone company symbol painted on its side, was a small one, the standard three quarter ton model so familiar to every citizen. It would attract absolutely no attention parked along the curb on "G" Street, SW. The fit was tight, but the parking casters were down, and once Coulson had worked his way in under the mouth of the forward duct, he had a bit more room to work. Flat on his belly like that, his cheek pressed against the damp macadam, he needed all his strength to pry up the cumbersome manhole cover over which the ducter was now parked. Coulson was a big man and none of his bigness was fat.

With the heavy cast-iron cover out of the way, Coulson dropped silently into the clammy space below. It was early evening, just dark enough to cover his movements under the ducter, and he relied somewhat on the heavy theater traffic on the street above to mask any slight noise he might make. But he didn't rely completely on it; Coulson was the sort of man who never relied very much on anything, or anyone, not under his absolute control.

By the light of a small flashlight he located the junction box mounted on the concrete wall of the wireway tunnel into which he had dropped. He broke the lead seals on the cover, removed the four screws holding it in place, and with a small induction meter began to check each pair of wires soldered into the terminal block inside. After a moment he found what he was looking for, and, working with sure swiftness, he attached jumpers to the appropriate lugs and brought an infinitely fine, nearly invisible shielded pair down through a spare knock-out in the bottom of the junction box. A few minutes with a screwdriver and the box cover was again in place, the seals forged of a dull gray thermoplastic which would withstand all but the closest inspection.

Down the wireway a few yards, Coulson found a transformer bank which furnished control voltages for the monorail running above the street under which he worked. He ran his hair-fine cable down the tunnel, stuffing it behind a convenient conduit as he went, until he reached the transformers. From one of the capacious pockets in his coveralls he drew a black metal box, twice the size of a package of cigarettes, and, after consulting the small brass plate on the nearest transformer, he inserted a fine screwdriver in the appropriate slot and set the voltage to match that of the transformer's output.

Working more rapidly now, he attached leads from the transformer secondary to the tiny pulse receiver, connected up the fine cable from the telephone terminal box,

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and stretched the receiver's short antenna out along the tunnel wall, carefully following a form mark in the concrete surface. With all in place, he pulled himself laboriously back up out of the tunnel, slid the ponderous manhole cover back into place, waited watchfully until the immediate area was clear of pedestrians, and slid grunting out from under the parked ducter. He drove off, then, and re-parked many miles away on a stretch of deserted country road paralleling the swampy banks of a broad stretch of the lower Potomac.

With the engine dead he waited for fifteen minutes, ears and eyes straining for any sign of activity near him. Satisfied that he was likely to remain unobserved, he pointed the ducter toward the opposite shore, a thousand yards off in the darkness, fastened a ninety-second timer to the power switch, restarted the engine, and watched the unoccupied machine, its ducted fans kicking up a faint wake in the dark river, head obediently toward the depths of mid stream. When he heard the diminishing sound of the engine cease, he listened for a moment for the faint hiss of air escaping from the sinking machine, and then set off wearily down the road to the nearest mono station.

Once again in the city center, Coulson left the mono at the cross-country flitter depot. Tool kit in hand, he entered, put a coin in a storage locker and removed a leather suitcase—not too new, not too old—went on to the men's room and dropped another coin in the lock on a booth, emerging a few moments later dressed in a conservative gray business suit, his dirty coveralls and specialized tools neatly packed in the suitcase. He waited a moment by the newsstand until a crowd of new arrivals from the Chicago flitter swept him along to the street and a rank of waiting taxicabs. After two changes of cabs sandwiching a walk of several blocks, he arrived back at the hotel room he had taken the night before. It was a little over two hundred yards from the manhole cover he had lifted four hours earlier.

The room smelled musty and unused, and after checking the traps he had set to detect intruders, Coulson threw the windows open, poured himself a stiff bourbon-and-water, and relaxed for five minutes with a cigarette. He showered then, dressed in clean clothing from the leather suitcase, and sat at the telephone for a few minutes, finishing his drink and marshaling his thoughts. At length, he dialed a number, listened to the ringer whirring away, and heard the click and change of tone when the receiver was lifted.

Knowing the man on the other end would say nothing, Coulson said: "This is Caesar. Sargasso is in place and ready to go. If I don't hear otherwise, I'll roll it tomorrow

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as agreed." There was no response, nothing but the soft susurrus of the man's breathing followed by an impersonal click as the connection was broken.

Coulson, too, hung up, left the hotel room, made his way through the lobby without attracting the desk clerk's attention, and took two taxicabs and the mono back to the White House parking lot on Fourteenth Street. He unlocked his battered '68 ducter, climbed in, and with a wave to the gate guard, drove the tiresome thirty miles out to Manassas and his home. At 1:00 in the morning, traffic was light, and he made it in just under twenty minutes. Mary was still awake, and, as he eased his tired body under the cool sheets, she snuggled up to him and made sleepy sounds of sympathy for the fact that he had had to work so late at the office.

At 8:30 the next morning, Coulson was back at his desk in the president's anteroom, going through the more important calls of the morning. There was one to the caterer, and Coulson was forced to spend much more time than he wished insisting that the '81 *Schloss Rheinberg* be served at the Friday night reception for the Eurofed Defense Minister. Then there was a call to the White House chef on the same matter, and a long-distance call to the Palmer House, where President and Mrs. Jacoby would be spending the weekend. At 9:15 he left his office, cautioning Miss Eckert to hold any calls for him, and after a six-block-walk down "E" Street, he took three taxis to within a block or so of the hotel room he had so briefly occupied the night before. By ten minutes before ten he had the teletape keyboard assembled and patched into the tiny transmitter in the bathroom. At ten sharp he fed the first of the tapes into the TD of the teletypewriter. Because they were in Russian, he could not read what they said. But he knew anyway. He'd helped compose the English originals.

By 10:08 the last of the tapes had been transmitted via the little impulse receiver in the manhole two hundred yards away, and Coulson busied himself at eradicating any trace of his occupancy in the room. He wiped door knobs and ashtrays free of fingerprints and dropped the single whiskey bottle and glass down the disposal chute. He packed his meager personal belongings and the teletypewriter keyboard and transmitter in a cheap suitcase, and then, suitcase in hand, he left the room for good and checked out at the desk below. By two taxis again, he traveled to Dulles International and checked his suitcase, and then by mono he returned to his office. It was nearly one o'clock, and he walked on to lunch in the cafeteria in the Briggs Building on E Street.

Two weeks later, Coulson found himself in London, in a temporary office in the American Embassy in

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Grosvenor Square. The London Conference between the Eurofeds and the Americas was due to start in a week, and Coulson had much to do to arrange the president's meals and accommodations in London. Friday was entirely taken up with conferences with the ambassador's staff and the embassy's Chief of Protocol. Saturday he spent talking with the staff of the embassy guest house in Knightsbridge, where the president and his party would be staying, and with the courteous gentlemen at Simpson's who would be catering the president's reception for Chancellor Elstrund at the Mayfair. Early Sunday morning, Coulson walked the damp pavements to Marble Arch and took the underground there to South Ruislip and the SAC missile base.

In the South Ruislip station, he spent a few minutes in the men's room making himself unrecognizable. He slipped a small block of wood into his left shoe, which produced a pronounced limp, pulled a black bowler low down over his forehead, reversed his jacket so that the checks showed, pushed sponge-rubber inserts into his cheeks to make his normally angular face rounder and more benign, and glued a fierce R.A.F. moustache on his upper lip. His passport, driver's license, and other personal papers he sealed into a plastic bag and dropped into the flush tank mounted high on the wall behind the toilets.

Thus disguised, and feeling a bit foolish for it, he walked the half-mile through the green April countryside to the main gate of the SAC base. There he presented his credentials—as a representative of the "British Friends of Foreign Orphans"—and was admitted to see the Duty Officer. He spoke in a high-pitched, nasal voice of his desire to enlist the support of American airmen stationed in England for his cause, and when the bored Duty Officer turned wearily for a form for his guest to fill out, Coulson triggered his gas pen and took a single quick step to catch the falling officer before he could hurt himself or crash noisily across his desk. Then a swift jerk at the red key dangling from the holder on the Duty Officer's belt and Coulson was off, walking with seemly haste back out through the main gate, the red key tucked into his vest pocket.

He was midway to the South Ruislip station before he heard alarm bells behind him, and he went to ground in a nearby wheat field until dusk had fallen and the hue and cry had clearly passed him by. Cold and weary, he abandoned the wooden block and the bowler, removed the moustache and the sponge rubber, and reversing his jacket so that it once again matched the conservative gray of his trousers, he slipped back to the tube station. There he flushed his forged credentials down the toilet, recovered his own papers, and sped back

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to London on the 7:15 to face a barrage of inquiries from the ambassador's staff on the president's taste for roast beef, wines, and kidney pie.

Two weeks later, back again in Washington after the London trip, Coulson was called into the president's study for one of his rare face-to-face meetings with Jacoby. As he entered the room the attorney general was just leaving.

"Sorry not to give you more time, Ed," said the president to his departing visitor, "but I have to get the arrangements for next month's Rio conference on the mono." Edward Allison nodded at Coulson as they passed. Coulson doubted that Allison was aware of his name, although he undoubtedly recognized him as one of those faceless myrmidons who handled the president's household affairs.

Jacoby waited until the door had closed behind the attorney general before he thumbed a row of buttons on his desk. Coulson knew that a vast array of human and technical agencies were now in force to protect the president's privacy. Nothing they said could be overheard.

"Good work, Lee," said the president.

"Thank you, Mr. President. How did it go?"

"Lovely. It was lovely, Lee. I wish you could have seen it. When the hot line started clacking away right in the middle of the National Security Council meeting, I thought old Allison would drop his teeth. That phony message in Russian really did the trick, and, when we got it translated and it turned out to be the old one about the traveling salesman and the French waitress everybody knew it was a hoax, but they couldn't figure out how it had been done. I'll hand it to Allison, though. His boys found your G Street tap in less than four hours, and he's taking steps to make the whole hot line absolutely tamperproof."

"How about the Command Circuit key? That business in London."

"Oh! That couldn't have been better. The Air Force went crazy. You should have seen the mealymouthed cables the Defense Secretary was getting! Still, they knew they'd goofed, and they've changed all the locks on the Command system and tightened up gate security the way it ought to have been in the first place."

"Work as well as that business with the 'For Sale' sign on the reactor down at Sandia?"

"Better. Even better."

The president got up from his desk and walked around to the window looking out on Fourteenth Street. "You know, Lee, our biggest problem is ambition: everybody all up and down the chain of command wants to get ahead, wants to show the next guy up the line just how sharp he is, what a fine state of readiness he and his

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unit are in. I can call for all kinds of surprise alerts, all kinds of tests and exercises, and somehow word always gets out in advance. This office is leaky as a sieve whenever more than two people are involved. As soon as I decide that SAC, or Orbit Command, or the subs ought to be given a surprise alert, someone talks too much, and all up and down the line they start humping, hoping they'll impress somebody enough to get a little gold star next to their names. Then, damnit, as soon as it's all over, they stick their feet up on their desks and go back to sleep. The only time they get a real surprise is when we—just you and I—pull something on them. And when we do, we always find something amiss, don't we. It's our only chance to keep them honest."

Coulson thought swiftly back over the previous three years, the fences he had climbed, the sewers he had navigated, the dirty little tricks he had pulled, each carefully calculated—often with broad and vulgar humor—to show up weaknesses without triggering a genuine alarm. "Yes, sir," he grinned at the president. "I guess we almost always catch them at something."

The president eyed his young assistant with some calculation. "I'm pretty generally satisfied, Lee. But the lead time between the decision to pull something on these birds and the actual test is too long. Every minute that an uncorrected situation lasts is so much more danger to the nation. I want you to sharpen up your support staff so you can get out and pull a job within hours after I get a report suggesting a soft spot."

Coulson remained silent. It looked like this was one of those days when the president was needling everybody. Sure, he might be able to work a little faster, cut the lead time somewhat, but didn't the president realize how much planning time it took? The work on false documents? The time in studying plant layouts . . . ?

The president, satisfied that he had achieved the effect he desired, softened his tone. "So how are you feeling, Lee. Tired?"

"No, sir, ready to go again when you say."

"Well, I haven't made up my mind yet what we'll hit next. Maybe the Cape, or Vandenburg. Maybe the MOLE command setup. I'll let you know."

Coulson knew perfectly well that the president knew exactly what his next assignment would be, but he would hold off as long as possible so he could see just how fast Coulson could work under pressure. "It would be helpful, sir, to have as much advance notice as possible. I know you want me to come up with test plans sooner, but the quality of the planning is pretty much a function of time."

"Yes, I know." The president grinned broadly at Coulson, dismissed him with a friendly wave,

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and returned to the mounds of papers on his desk.

Coulson rose and left the president's study, thinking of the payments on the house out in Manassas and his need to replace the '68 ducter parked in the lot outside. A promotion would come in very handy, and it looked like the best way to get one would be to impress the president with brilliant new speed in his work.

In the president's anteroom he paused a moment at Mrs. Levy's desk. She, the president's personal secretary for many years, was the only other individual who knew of Coulson's special work.

"Sarah," said Coulson, "what's the president got in mind for me next?"

Mrs. Levy looked down her long nose at Coulson, a disapproving expression on her thin old face. "If I knew, I wouldn't tell you. You know that, Lee."

"Aw, come on, Sarah. Be a sport. He's after me to speed up these tests. If I can have a few days lead time, I can really wow the old man."

"Well," sniffed Mrs. Levy, "I don't know for sure, of course, but I've heard him speak very unkindly lately of the management down at the Cape."

"Thanks a million, Sarah." Coulson swung off down the corridor whistling softly under his breath. With that much of a hint he felt sure he could study up enough on the layout, personnel, and security system at the Cape in the next few days to make a perfect attack when the order came.

Behind him, her voice far too low for him to hear, Mrs. Levy thumbed a button on her intercom. "It was just like you said, sir."

"What did you tell him?" The president's voice held laughter.

"Just what you told me to. About the Cape."

"Fine, Mrs. Levy. Fine. Now bring me the security file on the MOLE Command and cut orders for Coulson to go to San Diego." ■

THE ANALYTICAL LABORATORY

It's been a couple of years since we published the mechanism of the An Lab; it's time the new readers were informed—and the old readers reminded.

The essence of the An Lab is that Good Works Deserve Reward. If an author does you the favor of giving you some solid enjoyment with a good yarn, he deserves reward—and we propose to give him a bonus. We send the author of the story that wins first place a 1¢ a word bonus—with novelettes, that means an extra $100 to $200; on a novel, it may mean $600 to $900. Second place in the An Lab means a ½¢ a word bonus.

The score is compiled from letters readers *send in*. Since our staff is not yet telepathic, we can't record what you *think* of stories—only what you *tell us*. A

(Continued on page 105)

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CWACC STRIKES AGAIN

The CWACC was a slightly peculiar outfit—appropriately enough devoted to the furtherance and protection of quacks—but its Director had more fun than anybody!

HANK DEMPSEY

Jeff O'Hare admired himself in the hand mirror. "Yes," he said, "that's quite an Easter bonnet." The shining metal cap completely covered the top of his head, and from it sprang a porcupinelike collection of thin metal rods that projected in all directions. A thick bundle of insulated wires led from the side of the cap to a be-dialed and be-knobbed control box, out of which was clicking a squiggle-covered length of paper tape. A bell pinged dimly inside the box and the inventor, a squarish man with a thick black beard, mumbled to himself and threw a number of switches.

"There is your Electronic Phrenogram!" he announced joyously. He hurled the length of paper tape onto the desk in front of Jeff, who examined it in the dubious manner usually reserved for poisonous serpents.

"The fruit of my genius," the inventor shouted. "Product of years

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of exacting labor, the greatest addition to the science of phrenology since the death of the immortal F. J. Gall. The detector rods in the cap you wear are displaced vertically by the exterior convolutions of your skull. Attached to each rod is a sensitive rheostat that measures the degree of displacement, and the output of all the rheostats is recorded on the tape. What do you think? Will CWACC pay me a grant?"

Jeff took off the heavy cap and scratched his head. "Now that is a good question," he said, glancing back and forth from the cap to the tape. "Your gadget seems well designed and appears to do what it is supposed to do; the only thing that I am dubious about is your phrenology. Of all the nutsy theories to plague mankind, phrenology always seemed to me to be one of the wackiest . . ."

"Insults! I have not come to be insulted!"

"Hold on, Tiptoft, and let me finish. I said it seems wacky—and it does—but that doesn't disqualify your machine for a CWACC grant. Funds are granted by the Committee for Welfare, Administration and Consumer Control to further research of any kind, without any value judgment being involved. We have one researcher investigating acupuncture and another working spells to see if she can sour milk with them, so who are we to draw the line at a few noggin bumps . . ."

The intercom buzzed and he flipped the switch. "What is it?"

"There is a gentleman here who would like to see you, a police officer by the name of Sergeant Mannheimer."

"Grrrrk . . ! !" Tiptoft said and reached up under his beard to clutch painfully at his throat. Jeff looked at him with raised eyebrows before he spoke into the intercom.

"In a few moments, Miss Parker, as soon as my visitor goes." He flipped off and turned to Tiptoft. "Am I to understand that you have some acquaintance with our friend, the sergeant?"

"He's . . . on the racket squad."

"Explanation enough, I can understand and sympathize with you."

He depressed one of the buttons on his desk and a square of soundproofing slid aside in the ceiling above them, disclosing a dark hole. Tiptoft gaped as a large hook descended from the hole on the end of a thin chain. The hook stopped just above the top of the desk and Jeff slipped it through the carrying handle on the phrenogram box and hung the metal cap from its point. Another button reversed the process and Tiptoft's gape widened as his invention levitated towards the ceiling and vanished; the square of soundproofing slid back into place and the only evidence that the machine had ever been present was the paper in Jeff's hand—which he

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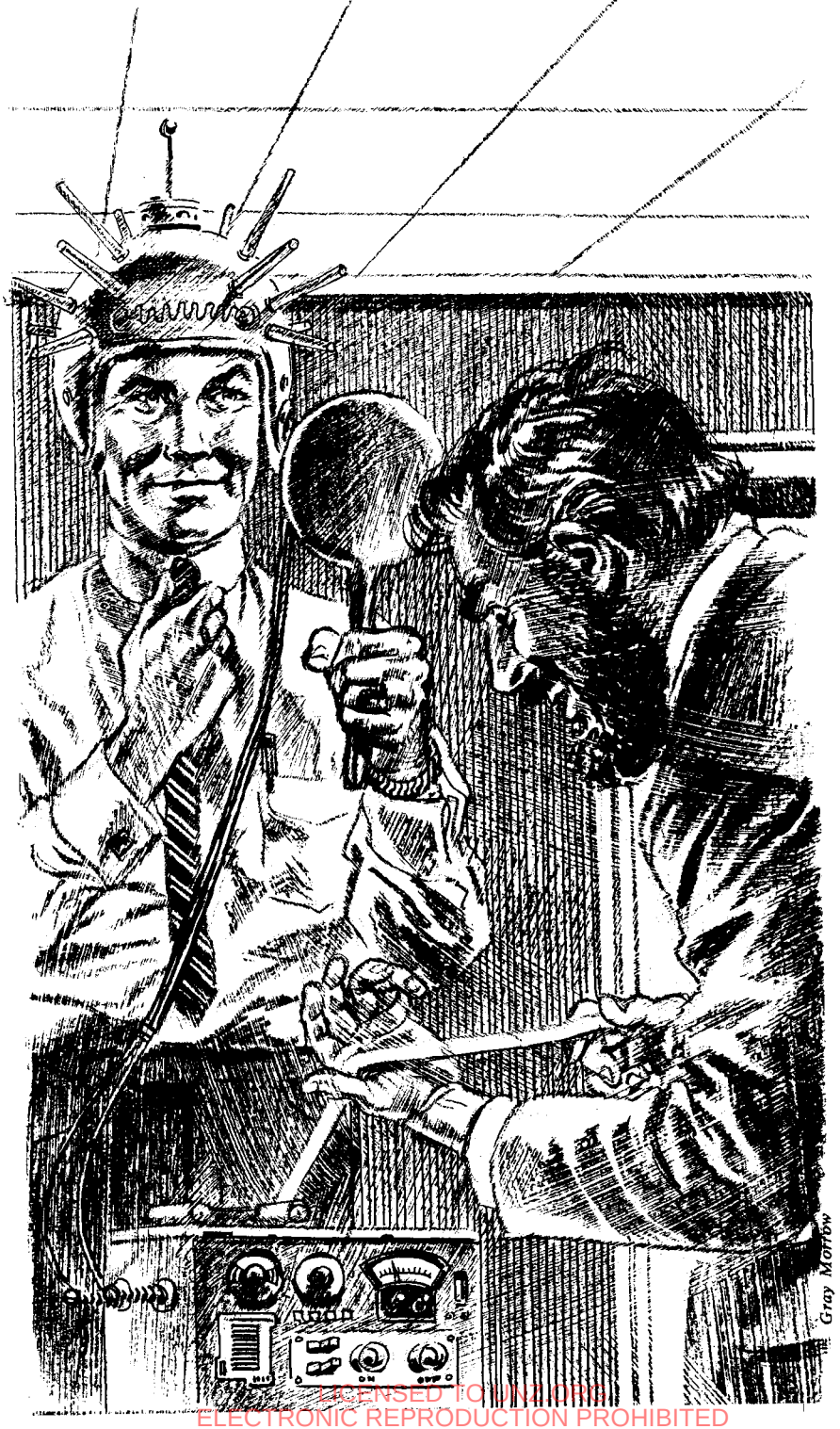

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dropped into a drawer and carefully locked.

"People," he said, "look for hidden objects in walls and floors, furniture and such—but no one ever thinks to search a ceiling."

"My brainchild!"

"Secure until your next visit when you will retrieve it. Please make an appointment with Miss Parker on your way out."

"Disaster! Mannheimer knows me by sight!"

"In the CWACC we brook no barriers." He slid open the bottom drawer of his desk and drew out what appeared to be a handful of bandages and a pair of dark glasses. The bandages were sewn to a cloth base which opened at the back with a zipper. He pulled the masklike device over Tiptoft's head and managed to stuff his beard up under it then, with some difficulty, closed the zipper. Tiptoft's frightened eyes looked out from two holes in the front until Jeff slipped on the glasses.

"There, you look like your head has been run over by a truck and has been well bandaged. I defy man or Mannheimer to recognize you in that. Please return it when I see you next."

He started the dazed inventor towards the door and signaled for Mannhiemer to be admitted. The two men met in the doorway and the detective's eyes bulged as they stuck there and struggled for a moment before they passed.

"What was that?" Mannheimer asked when the door had closed.

"The invisible man—don't you ever watch television?"

"No jokes today, O'Hare, please, I ain't feeling so good."

"Sorry. That was a business associate. Had a bad accident at the barber shop. The barber's razor—"

"Enough! I'm sorry I asked." The detective groaned and dropped wearily into the visitor's chair. "You gotta help me, O'Hare. If you don't help me, I'm a gone goose and maybe I'll commit suicide."

The words shocked Jeff into an unaccustomed silence. Every previous time that he had met the police officer there had been a good deal of friction between them and a certain number of mumbled threats on the detective's part. Jeff was wary; this might be a trick of some kind.

"Would you mind explaining?" he asked as he turned on the tape recorder with his knee.

"Did you ever hear of a con man by the name of Farquhar?"

"Never."

"What about a guy who calls himself Dr. Prof. Heringboot?"

"If you did your homework the way you should, or if your graft-ridden police department weren't too cheap to buy our CWACC yearbook—seven dollars *per annum*, postage included—you would know that we gave the good doctor a grant in 1957." Jeff turned and took one of the heavy, dark vol-

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umes from the shelf behind him and flipped the pages. "Yes, here it is."

"Is this Heringboot on the level?" Mannheimer asked. "I mean is he a real scientist?"

There was desperate need in the detective's voice and Jeff rejected a number of snappy answers because he knew the sergeant wasn't enough of an actor to fake this. "He is a scientist," Jeff finally said, "and a good one. He has a string of degrees as long as your arm, industrial patents that give him a nice income, an original mind, a good researcher. There is, well, only one thing wrong . . ."

"What?"

"He's as cracked as humpty-dumpty, has been for the past ten years. You'll find it all in the yearbook."

"I'll have him in the nuthouse tonight!" Mannheimer shouted, some of the old obnoxious overconfidence trickling back into his voice as he hauled himself to his feet.

"No, you won't."

"Why not?" he collapsed weakly back into the chair.

"He's harmless, that's why. You're not the first one who has tried to put him away. They took it to court and he won. Now he has a pet lawyer never more than five minutes away, a psychiatrist on twenty-four hour call, and a bodyguard who stays with him night and day. Isn't it time you told me what this is about?"

"It's terrible! I can't even tell the lieutenant. If I tell you, will you keep it quiet? If word leaks out . . . !"

"Scout's honor," Jeff said, holding up two fingers, crossing his heart and spitting. "The CWACC is very good at keeping secrets—as you should know."

"I know, I know," he mumbled gloomily. "I gotta tell you, because I need help. Someone in City Hall, someone *very* important, has got themselves mixed up with this con man, Farquhar, who is just about the trickiest confidence man in the country. He has never been put away so all we can do is keep an eye on him when he is in town and try and pressure him to move on. The wire shop, the horse parlor, the Spanish prisoner, he's played them all and we know it—but no one has as much as laid a finger on him yet, that's how good he is. He slipped back into town without our knowing it and has got an operation running with this Doc Heringboot and has already sucked in a mark. I just found out by accident and I can't tell anyone and if he works the mark I'm dead, finished, since I'm supposed to be running in the con men before they can pull this kind of thing."

"Who is the mark?"

"I . . . I can't tell you . . ."

"Good-bye."

Mannheimer sweated and suffered and vibrated and worked up his courage until he finally ground

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a name out through his chattering teeth.

"Nissing . . ."

"The new police commissioner!"

"Himself! I can't tell anyone because the commissioner is going to be very annoyed with anyone in the department who finds out he's been taken for a sucker. So . . ."

"So you've come to me to save your neck and the commissioner's. Have you thought of any way that I could do that?"

"Well . . . you know this professor, maybe you could talk to him, show him how he is mixed up in a phony deal and heading for trouble. Get him to pull out. With him gone Farquhar won't be able to work the mark by himself. Then, as soon as the prof is gone, we will put the squeeze on Farquhar and get him to leave town."

"A foolproof plan, sergeant—with just one vital piece missing. Why should I pull your chestnuts from the fire?"

Mannheimer looked uncomfortable and scratched his head.

"Go on," Jeff said with icy joviality, then nodded sagely when no reasons were forthcoming. "Very wise, not trying to appeal to my civil spirit or duty as a citizen. You know how I feel about the crooks in City Hall. Now I'm going to surprise you, sergeant—I'm going to help you. For one reason. Dr. Prof. Heringboot may be slightly around the bend, but he is as honest as the day is long and I'm sure he's not mixed up in this business of his own free will. The foundation has a certain duty towards him. Have you found out what the con game is?"

Mannheimer heaved a deep sigh and fumbled for his pack of cigarettes. "I haven't been able to get that close," he complained. "All I know is that there is some kind of invention involved so I suppose that they are trying to get Commissioner Nissing to invest in its development."

The detective groped in the cigarette package with a meaty finger, then crushed it when he found it empty. Jeff took out his own cigarette case and extended it across the desk.

"Have one of mine," he said, and pressed a button on the side of the case. A cigarette instantly appeared, projecting two inches from the case, and when Mannheimer pulled it free he saw that it was already lit.

"That's a great gadget," he said.

Jeff laid the case on the desk and nodded agreement. "It works fine, just too expensive to manufacture. Now, about this confidence man, Farquhar, I'll want his complete record as well as all the data you have on this case. The sooner the better."

"I'll type it up tonight, bring it over here myself."

"Is there any particular reason why you can't do it now?"

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"Yeah, I got to go to court. We're finally pressing charges against that quack doctor, you know the one, by the name of Hampstead. He was supposed to be defended by a drunk lawyer name of Anthony J. Blackstone, but I got the word just a little while ago that the ambulance chaser is in the hospital with D.T.'s. The case will be a pushover."

"Oh, it will, will it?" A more sensitive man than the sergeant would have noticed the icy change in Jeff's tones and would have been aware of the slight narrowing of his eyes.

"Yeah. I'll get that quack put away with five to ten." He beamed with self pride as he ground out his cigarette and reached for Jeff's case to take another.

"Would it interest you to know that Dr. Hampstead's defense is being paid for by this foundation?" Jeff said, his voice as silky as a leopard's purr before it attacks. "Also, Mr. Blackstone has been retained by the foundation as well. Since he is indisposed I will accompany you to court and conduct the defense myself." The leopard pounced. "And I'll see to it that the charges are dismissed and that you are laughed out of the courtroom, you bumbling idiot!"

"What?" Mannheimer gasped, and had the misfortune to be holding the cigarette case to his lips at the same moment—and pressing the button. The cigarette shot between his lips—and on into his mouth and vanished. He clamped his lips shut in delayed reflex and there was an explosive sound and smoke poured out of his nose.

"I swallowed it!" he gasped.

"Good for you," Jeff murmured, relieving him of the cigarette case. "Perhaps it will do something for your digestion. Shall we go to court now?"

They rode downtown together in a cab, in silence. The detective finally dredged up enough nerve to put the question to Jeff.

"Look . . . you're not going to let this interfere? I mean, you're still going to help me get the commissioner out of the mess?"

"Naturally," Jeff said, a monument of sweet reasonableness. "My right hand always knows what my left is doing—but neither interferes with the other. But don't think the offer of later aid will stop me from eating you alive in court."

When they climbed out of the cab in front of the courthouse a seedy man wearing a stained seaman's sweater sidled up to Jeff and handed him a thick briefcase. "It was behind the bar, at the Last Chance, just like you said, Mr. O'Hare," he whispered hoarsely.

"Thanks, Arpad," Jeff said. "I've already had five bucks credited to your tab there, so you can finish the alcoholic destruction of your vocal cords."

"That's just what I'm gonna do," he rasped, and slid away.

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"Until we meet in court then, sergeant," Jeff said with a cold smile. "And you go down in flames."

It was a rout, a disaster. But not for the police. Jeff sat quietly, saying nothing, while the prosecutor browbeat and intimidated the shivering Dr. Hampstead, nor did Jeff challenge or question any of the witnesses who moved through the chair in a condemning stream.

"I should have stayed in Florida," Dr. Hampstead told Jeff, cracking his knuckles in horrified apprehension. "I'll never live the winter out in the air-cooled pen this state has. I should have remained on the golden sands as you suggested—I only returned because No-cold seemed so foolproof, a boon to humanity. I am a sacrifice on the altar of injudicious civil law enforcement."

"If you mean that the crooked cops in this town have it in for you—I couldn't agree more. But you're back, and on trial, and we still have a trick or two up the old sleeve. Be strong!"

When Jeff stood to face the court there was an expectant silence.

"No witness . . ." he said.

"No witnesses?" The judge looked shocked.

"No, Your Honor, there is no need for them. The prosecution has produced enough of them and I have no intention of wasting your valuable time with more, on a case which should never have been brought to court in the first place because of insufficient evidence. The nostrum which Dr. Hampstead has had manufactured and sold under the catchy name of No-cold is exactly what he claims it to be, and I shall so prove to this court."

"I object, Your Honor," the prosecutor broke in. "A number of expert witnesses have come before us and shown, beyond the shadow of a doubt, that there is no cure for the common cold . . ."

"No cure *they* knew about," Jeff said. "None of them ever tested No-cold and I have positive proof that No-cold is exactly what it says it is."

"Objection overruled." The gavel banged.

"Thank you, Your Honor," Jeff said, and rustled the thick wad of papers in his hand. "Now, for the sake of the records: Every bottle of No-cold is labeled with its contents and directions for use, and when taken, dissolved in milk as directed, will produce the results as stated."

"I protest!" The prosecutor was on his feet again. "This quack potion contains nothing except some common vitamins and a little iron and calcium. It's worthless. Any druggist will sell you—"

"Any druggist will sell you aspirin!" Jeff interrupted. "Whether it is called that or by a fancy trade name or acetylsalicylic acid. But under *any* name it is still the drug of choice for a number of ailments

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all the way from headaches to rheumatism. Availability is no measure of effectiveness."

"Overruled, Mr. Prosecutor," the judge said and banged his gavel tiredly. "And don't you think you could limit these interruptions, or we'll be here until next week."

The flushed attorney dropped into his chair and Jeff gave him a smile of wonderful innocence. "I shall not be much longer," he said. "The label on each and every bottle of No-cold states clearly that when taken as directed it prevents colds in children. And it does. I offer in evidence this scientific document as exhibit A. It is a study made in 1961 by Dr. Frank E. Barnes, Jr., who is chairman of the Committee on School Health of the North Carolina Medical Society. Dr. Barnes made a study of the local high-school basketball players, both boys and girls, and found that a ridiculous diet was eaten by the

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majority of the children and that only *two* percent drank an adequate amount of milk daily. The doctor did his study during a period of three months and found out that those children who received vitamin supplements avoided colds and did not miss any classes during those winter months. While the control group of children, living only on their 'ridiculous' diet, missed classes and were down with the usual number of colds."

The prosecutor was on his feet again, triumphantly waving a piece of paper. "If I may interrupt, Your Honor, we already know of this so-called study. But we also know that the report was rejected for publication by the *Journal of the American Medical Association* on the grounds that high-school students do not need vitamin supplements in their diet. Did you know about *that,* Mr. O'Hare?"

"I know about that," Jeff said in just as oily and unctuous a voice. "I also happen to know that the editors of the *A.M.A. Journal* are wrong, as editors and members of established scientific authority have been, from time to time, in the past. And I think you had better withdraw your statement about Dr. Barnes' report being 'so-called'. Are you calling him a liar? Do you doubt the scientific accuracy of this carefully done work? Remember—the A.M.A. editors just gave an opinion, a wrong one in fact, that vitamins don't aid high-school children. Will you go further . . . ?"

"Perhaps my words were a little hasty," the red-faced prosecutor said. "If there could possibly be any cause to misinterpret them, I shall be happy to have them struck from the record."

"And just in time, too," Jeff added, holding out another sheet of paper. "Exhibit B. At a symposium on Nutrition in Medical Practice in 1964, three years after Dr. Barnes' study, there were a few words said on the subject by Dr. Robert W. Hillman of State University of New York, Downstate Medical Center. Dr. Hillman said, and I quote his very words, that: 'the teen-ager—and especially the teen-age girl—is the worst-fed member of the household. . . . As a result, up to three-quarters of the population of teen-aged girls may be two-thirds deficient in such nutrients as vitamins A and C, thiamine, riboflavin, calcium and iron.' So it has been proven that most teen-agers have vitamin deficiencies, despite any official or unofficial opinions to the contrary. It has been proven that children with vitamin deficiencies suffer from colds. At a fair and competitive price for its contents the solution, No-cold, when taken with milk as directed, will make up the dietetic deficiences—and will prevent colds. The defense rests."

"You have done it again, Jeffrey O'Hare, and I shall be in eternal

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debt to you." Dr. Hampstead's voice quavered with emotion as he pressed Jeff's hand between his.

"All part of the service of the foundation, Doctor. All I ask in return is that you accept a little suggestion. Florida . . ."

"I am on my way now, I was a fool to ever have returned to this evil metropolis. There are other cities that would benefit just as well by the fruits of my discoveries."

"Just remember that the next time you have an urge to save mankind." Jeff waved as they parted in front of the courthouse and flagged down a cab.

It was just five when he entered the CWACC office and his secretary, Sally Parker, was giving her nose a last dusting in the wall mirror, before hurling herself into the rush-hour battle. Jeff ran his eyes happily over her slim figure as she stood on tiptoes to look into the glass. "I must say that outfit does a lot for your natural attributes. But, are you becoming a beatnik or are the knee-length knitted stockings a desire to return to the simple, peasant days of America's youth?"

"Mr. O'Hare," she said, closing her purse and giving him one of her most disdainful sniffs. "I am wearing these awful objects in the pursuit of pure science. And money." She rolled one of the heavy stockings down to reveal another and thinner stocking beneath it, this one of a particularly horrible and mottled purple color. "For eighteen months now I have been wearing these awful stockings in the office, and they will not wear or tear in any way. You may recall I receive a grant of twenty-five dollars a month for this service. You may also remember that you have been after me for ages to give them more wear outside of work. I have now devised this plan to wear them abroad without embarrassment, for which you will raise my grant to fifty dollars a month."

"Forty," Jeff said, filling out a voucher. "As long as you have them in shrouds they can't be snagged. But it's worth the extra fifteen for the extra work. Sign here."

"You, sir, are a cheapskate, you and your cheapskate foundation." She angrily scrawled her name.

"You should know—you're the only other employee."

Jeff was alone in the office and it was a good chance to catch up on some paper work while he waited for Mannheimer. He put Sally's voucher in the *Mr. X* file and made a note of the increased testing time on the apparently indestructible stockings, in the hopes that their mysterious inventor—about whom they knew nothing—would return one day and reveal the secret of their construction.

To encourage himself in his labors, Jeff had dinner sent up from the restaurant across the street—and a bottle of bourbon from the

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package store around the corner. By carefully dividing his attention between them and intermittently scratching through the files and taping some letters for Sally in the morning, he pleasantly passed the time until nine o'clock when an officious hammering on the hall door announced Mannheimer's arrival.

"Come in, Sergeant," Jeff said. "And from that expression of deepest gloom on your honest face I would say that this has not been one of your happiest days. Come in, have a seat, and I'm sure that you are off duty enough to join me in a drink, and if you won't mention this afternoon's trial neither will I."

The detective fell heavily into a chair, accepted the drink and handed over a thick envelope—all without a word. Jeff respected the silence and flipped through the contents of the folder while he sipped at his own drink. "Very interesting," he said when he had finished. "Your records tell me far more than I care to know about Farquhar, but absolutely nothing about the present operation except the address of Dr. Prof. Heringboot's laboratory. This operation needs more intelligence—in the military sense of knowledge, that is, no slighting reference to your undoubted, though well concealed, powers of mnd."

"How you going to find out anything?" Mannheimer asked glumly. "Bug the place? I tried that—with no results. You don't catch an old hand like Farquhar that easily."

"Of course not—I catch him a lot easier. I'm just going to walk in there and ask them what is going on."

"You're going to *what?*"

"Come now, Sergeant, don't bulge your eyes in that unattractive manner. The Doctor Professor is an old friend of this foundation and will be happy to see me. We are always interested in his work. Farquhar will have to put up with my presence and he has no legitimate complaint because this is supposed to be an aboveboard business matter." Jeff took an electric razor from the closet and began going over his face while he talked. "I'll go there tonight, you can phone me in the morning and I'll give you a complete report."

"You're looking for trouble, O'Hare—this Farquhar is a tough nut. There have been a couple of guys that disappeared that we think he had a hand in."

"I take it that your suspicions are more accurate than your grammar." He clicked off the shaver and stowed it away in the closet, emerging this time with a luxurious leather attaché case with gold fittings. "O'Hare is a tough nut, too, and can take care of himself. We'll get to the facts—and this will help." He opened the attaché case and pointed to the built-in tape recorder. "The microphone is concealed in the handle, very useful gadget." He weighed the empty

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case thoughtfully, then added a ream of typing paper and the bottle of bourbon for ballast.

"We'll share a taxi," Jeff said turning off the lights. "You can drop me around the corner from Heringboot's laboratory and the police department can pay the fare."

There was only silence on the trip downtown, and Jeff waited until the cab had vanished before he walked around the corner to Newby Street. This section of the city was devoted to light and heavy manufacturing and the storing of these products, and was almost deserted after dark with just an occasional car passing under the widely separated street lights. Number 32 proved to be a small and shabby four-story building almost hidden by the giant warehouses that surrounded it. Jeff climbed the short flight of crumbling, stone steps, straightened his tie, pressed the corner of the attaché case that turned on the tape recorder, and rang the bell. Almost at once a light came on inside, he could see it through the fanlight, and after a great rattling of locks the door squealed open.

"Welcome . . ." a man said, blinking out into the darkness. Then the warm tone of his voice went frigid. "Who are you?"

"Jeffrey O'Hare," he said brightly, "And I'm here to see Dr. Prof. Heringboot, if you please."

"What do you want with him," the other snapped. He was tall and lean, with a pleasant face, well tanned, that sported a British-officer type moustache. Jeff had recognized him as Farquhar, from the pictures in the police file, but kept this fact to himself. He ignored the other man's tones of anger and answered with the voice of sweet reasonableness.

"A personal matter, I'm sure you wouldn't be interested. Now—if you would be so kind as to inform the doctor that I am here . . ."

Jeff smiled blandly while Farquhar chewed his lip in a crisis of indecision. He glanced about at the empty street and made his mind up. "All right, come in," he said.

He led the way up a musty flight of stairs and threw open a door. Jeff had just a glimpse of a large room fitted up as a laboratory of some sort, when his attention was drawn to a man in a white laboratory smock, with his back turned, who was working at one of the benches.

"Dr. Heringboot, there is someone to see you," Farquhar said. The man turned. "Yes?" he said.

Smiling warmly Jeff stepped forward. It had been years since he had last seen Heringboot, but he knew him well from their past association. "Dr. Prof. Heringboot, this is a pleasure," he said.

He had never seen this man before in his life.

"What is it you want?" the pseudo-Heringboot asked. He was a small man with sandy, thin hair and

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a very worried expression. Jeff smiled warmly, but did not answer until he had turned to place his attaché case on a nearby table. He was thinking rapidly.

"Dr. Heringboot, my firm has sent me here on a confidential matter. If you would be so kind—here is my card." Jeff opened his wallet and flipped through the plastic dividers until he found a business card, extracted it and handed it to the man. He, of course, had to flip through the dividers because each of them held a different kind of card.

"J. J. O'Hare," the imitation professor doctor read. "International Funds Ltd., Bern, Schweiz. But—what does this mean? What is it about?"

"Ist iss eine konfidentialische mattervotter," Jeff intoned in a thick, teutonic voice.

"Please speak English. I do not speak German here in this country."

You don't speak it any other place either—if you believe that was German, Jeff thought to himself. His smile was even broader. "Of course. I was just explaining that this was a confidential matter." He rolled his eyeballs theatrically towards the hovering Farquhar.

"That's perfectly all right, tell me what you want. Mr. Farquhar is my partner, I have no secrets from him . . ."

A distant, ringing bell interrupted him and he glanced towards Farquhar who mumbled something distinctly unpleasant under his breath as he left the room.

"Couldn't this matter wait until some other time," the mock doc said nervously. "We have an important meeting this evening and there won't be time for anything else."

Jeff mumbled as incoherent an answer as he could and kept one eye on the door. They exchanged excuses for a few moments until Farquhar returned. When Jeff saw who was with him his smile broadened until it was not unlike that of a hungry alligator's.

"Mr. Nissing," he said, rushing forward, "what a happy coincidence, meeting you like this. It is because of you that I am here."

Nissing drew back, his beady eyes staring suspiciously from behind the ramparts of his fat cheeks. "And who are you, sir? I never saw you before in my life!"

"Nor I you, sir." Jeff whipped out another of the same cards and proffered it. "But you will understand when I say that you are a well known and prominent figure and I have, of course, seen your likeness in the newspapers. But more than that, my firm has recently become aware of certain investment plans of yours and I am here to see if I can be of any aid." Jeff blandly ignored the strange looks the three men were hurling back and forth at each other as he rattled on. "International Funds is a world-wide firm with investments in every part of the globe. Our operation is so suc-

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cessful that we, ha-ha, suffer from an *excess* of money, and you know how bad that is. Money works for you, sir, and uninvested capital is a waste. When we heard that Dr. Prof. Heringboot had an invention that needed financing I was dispatched at once. When we heard that you, Mr. Nissing, were also investing, I rushed even faster. Tell me, do not leave me in suspense—are you underwriting all the developmental costs or is there still a small spot for us? My checkbook is in my pocket and I am instantly ready to write a check for any sum."

The two con men were suffering silently, but Nissing relaxed and actually smiled as he rubbed at his fat jowls. "Very glad to hear this, O'Hare. I have been considering investing, but the sum was rather large and I'll be only too happy to have a partner in this venture."

"And what would be the size of International Funds' contribution?"

The piggy eyes were half closed. "Could you, say, see your way clear to putting in . . . one hundred thousand dollars?"

Jeff took his pen out and smiled patronizingly. "Is that all? Ahh, we had hoped this was a *big* investment. But small or big, we back them all." He reached towards his inner pocket, but stopped his hand halfway. "I'm sure you wouldn't mind my having a look at the invention before signing the check."

"I'm sure the professor wouldn't mind," Nissing said. "But—you said you knew all about it?" There was more than a touch of suspicion in his voice.

"*Knowing* about a thing and *seeing* the proof are entirely different," Jeff said, treading lightly along the edge of the precipice. He hadn't the slightest idea yet what the invention was about.

"Of course, of course, you'll have to have something to tell to your principals in Bern. How about it professor? Mr. Farquhar?"

Both these individuals smiled insincerely and wriggled inside their clothes, but there was no escape.

"Go ahead, Doctor," Farquhar finally said. "We would all enjoy seeing your incredible machine in operation."

"That's for sure," Nissing said enthusiastically. "It really has to be seen to be believed."

The substitute Heringboot turned to a large control panel and switched on the apparatus. "The destruction of matter requires a good deal of power," he said, "as does its reconstruction once it is in wave form." Jeff raised his eyebrows but said nothing. "While the transmitter apparatus is being charged up I can demonstrate the operation of the matter destroyer—"

"This is the absolute best," Nissing said, "I never get tired of watching it in operation."

"Would you please hand me one of those beer steins, Mr. O'Hare," the doctor-professor asked. "In

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fact, you can aid me by placing it between the polarizing plates of the matter destroyer, but be careful to take your hands away before I activate it."

There was a box on one of the tables filled with thick, cheap beer mugs. Jeff took one up and weighed it in his hands; it was solid, chunky glass and seemed completely normal in every way. He placed it on the foot square sheet of metal as he was directed. The metal plate stood on heavy ceramic insulators and there was another plate, a twin of the first, suspended a foot above it by more insulators. In this way the two plates formed the bottom and top faces of a cubic foot of space.

"Stand back!" the imitation Heringboot shouted dramatically as he threw a large knife switch on one of the panels. The dynamo changed tone as it labored under the load and there was a slight discharge of static electricity from the insulators that held up the plates. This was all that could be seen, not very exciting at all—except for the fact that the beer stein grew misty, fading away before their eyes until, with a faint crackling sound, it vanished completely.

As the dynamo moaned into silence Jeff realized that he was standing stiffly with his jaw hanging open. He closed it with a sharp clack and jumped forward, swinging his hand back and forth between the plates and encountering nothing more resistant than thin air.

"Impressive, isn't it, Mr. O'Hare," Farquhar murmured into his ear.

"Yes," Jeff said, grabbing at the cracked shards of his composure, "but no more than I expected after reading the reports."

"And exactly *what* did these reports say?" Farquhar's voice was sharper now.

"How about that, O'Hare, how about that?" Nissing boomed.

"Tremendous!" Jeff told him, escaping from the hovering Farquhar. "So tremendous that I would love to see it done again. How about you, Mr. Nissing?"

"Never get tired of it. How about it, professor?"

The pseudo professor leveled a look of smoky hatred at Jeff but silkily reassured Nissing that he was always ready to oblige. This time Jeff prowled around and examined the two plates from all sides and even from underneath and stood so close when the second beer mug vanished that there was a crackle of static electricity from the tip of his nose. He knew a lot about the various ways machines and gadgets could be rigged and he was sure that there was no chicanery here.

Whatever force flowed between those metal plates *did* make the glassware vanish.

"Your matter destroyer seems to be very efficient," he said, as calmly as he could. "Now I hope that the transmitter apparatus you mentioned is just as interesting."

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"You're right as rain," Nissing agreed. "There's no future in just taking things apart, you have to put them together again if there is to be any money in it."

"Of course, the transmitter," the fake professor said surlily, and turned to the control board to conceal his anger. "In the demonstration you have just witnessed the beam of electronic vibrations has simply destroyed the object, dispersed its material into the air as a cloud of subatomic particles. However, in the sealed chamber of the transmitter, the particles are used to modulate a wave of very refined energy which is transmitted to the receiver where the object is reassembled again in its original form, uninjured and unaltered by its voyage. Of course in this case, for demonstration only, the transmitter and receiver are located in the same room, though in our field tests successful transmissions were carried on at a distance of over some fifty miles."

"And with a little capital the power can be increased to cover any distance," Nissing said. "That's what they told me and I guess you can see, commercially-wise, what that means, O'Hare." He started to unstrap the watch from his wrist. "Here, you can use my watch, just like you did last time."

Jeff caught the worried glance that the phony scientist shot at Farquhar, and it was the con man who smoothly answered the queston.

"I don't see why not. Any object can be transmitted, any object at all."

He put his hand out for the watch, a thin, wide, crystal and eighteen-karat oyster with a brazenly expensive gold band. Nissing gave it to him and Farquhar turned to pass it on to the false Heringboot, turning his back to do so. Jeff smiled happily—this was more like it. And, as the professor demonstrated the machinery, the smile grew wider and wider.

"I put the watch into the transmission chamber, which in this case must be sealed off and evacuated because the presence of any air interferes with the action of the scanning wave. But a glass window has been installed in the front of the chamber so that you may watch the process."

He bent behind a bulky piece of machinery while Jeff and Nissing watched through a thick glass port set into the front. The familiar insulator-mounted plates were visible inside, then the professor's hand as he put the watch down. An air pump began to hammer and they waited a few minutes until the reading on the pressure dial was satisfactory.

"Watch this," Nissing said proudly. "Just watch this!"

The dynamo hummed, electricity crackled and the watch faded from sight until it vanished and the chamber was empty. Across the room more sparks spat on a duplicate machine, mounted as this one was

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with a dish-shaped aerial, near which Farquhar was standing. Nissing trundled heavily across and pointed in the window at the watch.

"Now how about that!" he chortled and spun the sealing wheels on the side of the box. Air hissed in through the seals and a moment later he held the watch in his palm, chilled with frost from the vacuum —and perhaps the treatment it had undergone.

"Still ticking and keeping good time," Nissing said, turning the watch over and pointing to the lines of engraving there. "My watch without a doubt, unharmed, the inscription just as plain as ever. What do you say O'Hare—is International Funds interested?"

"You can bet your bottom dollar that we are," Jeff said happily. "A most illuminating demonstration and—"

"Perhaps you will want to examine the machines and principles of operation, Mr. O'Hare," Farquhar broke in smoothly. "I am the business partner and know nothing about these things. Why don't you stay here for a few moments and talk to Professor Heringboot, ask him anything you like. I have some matters to discuss with Mr. Nissing and we will rejoin you in a few moments."

Farquhar's trained con man's hand was already guiding the commissioner towards the door while Jeff thought quickly. As long as Nissing was around they couldn't pull any funny business with him, and this looked like a smooth ploy to separate them. But the whole business was chancy—and he certainly had nothing to fear from the scrawny little fake scientist. He flexed his muscles under his coat.

"By all means," he said heartily. "I'll have a pleasant chat with the Herr Doctor Professor."

The door closed as they left and Jeff turned. The other man was walking towards him with his hand raised as though he were going to shake hands. Jeff started to say something, but at the moment he realized the man was holding his arm and for some reason it kept bending in the wrong direction as though it were going to break off; he followed it around to ease the pain.

"Hey—!" he said, but there was a sudden crunching sound that bounced about inside his head and all the lights went out.

Consciousness returned accompanied by a number of unpleasant sensations which Jeff struggled to control before he opened his eyes. When he finally did so he saw a ceiling swinging in swift circles above him; he forced it to slow and stop only with great and painful concentration. It was dusty and cracked, decorated with ancient spiderwebs and adorned with a single dirty light bulb in a wire cage. His neck hurt, his head hurt, and his stomach heaved about like a raft on a stormy

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sea. When he turned to look around him, lightning shot between his eyeballs and he groaned aloud.

"About time you awoke from your drunken slumbers—overindulging at your age, *Dummkopf!*"

The voice had a rasping, familiar quality to it and Jeff forced his eyes open again and squinted at the man seated across the room from him. A thin old man with tufts of white hair behind his ears and a pair of old-fashioned, gilt frame pince-nez glasses clamped infirmly onto the bridge of his red-tipped nose.

"Doctor Professor Heringboot, I presume," Jeff said, and with each word his head pulsed as though a mighty drum were beating within it.

Heringboot turned away from the cluttered laboratory bench and blinked at Jeff over the top of the glasses. "You know my name?" he asked.

Jeff pushed himself up slowly until he could sit on the edge of the hard cot. "You know me, too, professor. Jeff O'Hare of CWACC. You relieved us of some funds for a grant once."

"Aha! I thought the face was familiar; O'Hare of course. But the years have not treated you kindly, less hair and that sort of thing. And the drinking."

"It was the boys upstairs who didn't treat me so kindly, doc. And I have *not* been drinking. What you are looking at are the results of contusion, abrasion and concussion. My head hurts."

Heringboot climbed down from his high stool, pattered over to Jeff and peeled back one of his eyelids like a fishwife skinning a flounder.

"Oww!" Jeff said as the lightning stabbed again.

"You may be correct," the scientist mused. "The pupil indicates possibility of a blow on the cranium as does the blood on the shirt collar." He began rummaging through a large cabinet filled with bottles, taking down one after another and mumbling to himself. "Chlorpromazine hydrochloride . . . Picrotoxin . . . Oxtriphylline . . . Desoxycorticosterone acetate . . ." With swift motions he began to mix a number of these chemicals together in a beaker, then reached for a bottle of distilled water. "Are you sure you weren't drinking?" he asked Jeff.

"Positive."

"Then a tincture will be more *bessere.*" He slopped in a great gout of ethyl alcohol and a small amount of water and brought the beaker over to Jeff, stirring it with a glass rod. "Drink this down to the last drop and your troubles are gone, *kaputt.*"

"Are you sure I won't be *kaputt?*" Jeff asked suspiciously, looking at the bubbling contents of the beaker. When the professor pulled the rod out he expected to see it half dissolved.

Heringboot urged him forcefully to drink and his will power was at low ebb so he obeyed. Outside of some preliminary internal rum-

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blings, like the warning of distant volcanoes, the potion went down easily enough and very quickly a happy numbness surged through his system, followed by a wave of enthusiasm and a feeling of power.

"That's great stuff," Jeff said, standing and flexing his muscles, feeling ready to tear down stone walls. "You ought to patent it. You have a fortune waiting there for a hangover cure and general pepper-upper."

"The fruits of my genius fall like rain—I have no time to waste on commercial transactions." He went back to the laboratory bench and began to clatter the glassware.

"You wouldn't happen to know a man by the name of Farquhar?" Jeff asked, runnng his hand through his pockets. They were empty; wallet, checkbook, everything gone. He shrugged and went over and rattled the handle on the steel door set into the concrete-block wall. It was unmoving and had a healthy solidity about it.

"Of course, I know him—he is my lawyer."

"Lawyer?" Jeff's still recuperating brain stumbled over this confusing thought. "But what happened to your old lawyer?"

"Accident. Very tragic. Both legs broken by a hit and *rennen* car, and he is still in the hospital. He sent a letter saying Farquhar was the best man for the job."

"I see," said Jeff, and what he saw was a staged accident and a forged letter, child's play for an old hand like Farquhar. "There is another man whom you may know. I don't know his name but he is a short guy, worried look, has sandy hair that is getting thin on top—"

"You are discussing Scobie, my bodyguard. . ."

"Bodyguard!"

". . . Very wise decision on my part." Heringboot ignored the interruption as he hooked more piping to the condenser. "Very efficient. Saves money, too. Two in one. He is my assistant as well, a trained laboratory technician of experience, and at the same time is an expert with the judo, what you call a Schwarzgurtel."

"A black belt, I might have known," Jeff said, rubbing the contused back of his neck. "The parts are all falling into place. I think the time has come to get out of here and make a few alterations in their plans."

"You cannot leave," Heringboot said abstractedly as he adjusted a Bunsen burner under the towering collection of glass. "The door is stuck again, they don't seem to be able to fix it. And that is the only exit from this cellar."

"Very neat," Jeff said, inspecting the walls. They were solid concrete and there were no windows. The only other opening was a circular coal-hole in one wall, but it was covered by thick metal bars that had been welded to the iron frame.

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It angled upwards for a few feet and he could just make out a metal lid on the other end that did not seem to be secured in any way. The coal chute was wide enough to get up and the lid could be easily removed and he could escape the cellar that way—except for the bars.

"Did Farquhar ever give you any papers to sign?" he asked the scientist.

"Of course!" the old man snapped testily. "That's what I hire a lawyer for. I have no time to read that sort of thing. He brings, I sign."

"You are being victimized and cheated, Dr. Prof. Heringboot," Jeff said dramatically. "Farquhar is a fake and your precious assistant is passing himself off as you and they are working a big con and undoubtedly using papers you have signed to verify it."

"Boys will be boys," Heringboot mumbled while he squinted at a column of rising bubbles. "I expect to be cheated. Just as long as enough money is left for my experiments I do not care. My lawyer is hired to keep me out of the *Nervenheilanstalt,* the asylum, and he will keep doing that in order to keep the money coming in for himself. I am crazy all right—crazy like a fox! Hah!"

Jeff controlled his temper. He had to get Heringboot on his side or he would never get out of this cellar. The precious pair upstairs must be ready to milk their mark tonight and blow town if they were willing to take a chance on locking him down here.

"I need your help, Professor," he explained patiently. "Your lawyer and bodyguard-assistant are finishing off their dirty business right now. They've rigged up your matter destroyer. It must be yours. They would never . . ."

"I have never heard of a matter destroyer."

"A gadget with two metal plates on insulators. You put something between them and turn on the juice and it vanishes."

"Unwissenheit!" Prof. Heringboot shrieked and knocked over a yard of glassware. "This is *lacherlich!* You are describing my Einsteinian Space-Time demonstrator. It has nothing to do with the destruction of matter. I merely built it to prove a point in the theory of spatio-temporal coordinates, then I told that *schrecklichschuft* of an assistant to dismantle it."

"Then it is not a matter destroyer?"

"Matter destroyer—what kind of nonsense is this?" the professor shouted, waving his fist angrily over his head. "You are the one should be put away, not me, saying something like that. I told you it was a demonstrator; it does not alter space, but it can be dangerous, highly dangerous to use. I must stop them!" He ran to the door and tugged angrily at the handle.

"Locked," Jeff said tolerantly. "I

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have a feeling they want us both down here where we can't cause any trouble. There is another way out. . . ."

"Where?" Heringboot shouted, pacing the floor like a caged lion.

"There," Jeff said, pointing to the ancient coal chute. "We could get out that way if those bars weren't over the opening."

"Bars! Bars are as nothing to Heringboot, I laugh at bars! Those fools . . ." He muttered angrily to himself while he tore open the cabinet and began to quickly assemble apparatus on the table. "Something simple . . . there is not the time to waste . . . cellulose nitrate, what they call the gun-cotton, that is the answer . . ." There was a rapid gurgling as he filled a crock with nitric acid. "And then some cellulose . . . $C_6H_{10}O_5$ . . . yes, yes, that's it!"

Jeff looked on interestedly while the angry scientist threw open the door of the first-aid cabinet and ripped out lengths of absorbent cotton. He started to stuff this into the acid, then broke off to root out a bag of plaster of paris and began to make a paste from this in a large bowl. Working with both hands at the same time, muttering constantly, he produced a wicked looking wad of gun-cotton and a half-congealed sludge of plaster. Jeff held the containers while Heringboot applied the explosive to the iron ring that held the bars over the opening, then slapped on a covering of plaster. The plaster was practically hard by the time he poked a hole in it and inserted a piece of alcohol soaked string for a fuse. Then he washed his hands, buttoned his white laboratory coat and put on an immense black fedora hat that hung on a hook next to the door.

"I am ready," he announced. "Shall we leave?"

"After you, Professor."

"*Gut.* I would suggest the back to the wall over there with the work bench for shelter. There will be noise, some flying particles, and it is best to take precautions . . ." He touched a match to the fuse and scuttled back out of the way, crouching next to Jeff.

The fuse smoked and crackled up to the plaster and the thing exploded with a thudding boom. Jeff looked on in admiration as the ring and bars flew the length of the cellar and clanged against the far wall.

"Satisfactory," Heringboot said, stepping through the cloud of smoke and dust and examining the jagged opening in the wall.

Jeff wriggled up the chute, pushed off the cover and hauled himself out. There was still plenty of ancient coal dust in the chute and Heringboot complained loudly about the condition of his white coat when Jeff pulled him up and had to be hushed into grumbling semi-silence. There was enough reflected light from the sky for them to see

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that they were in a junk-cluttered back yard, walled in on three sides by tall buildings and on the fourth by the shabby rear of the building they had just left. Light glimmered around the edges of the drawn curtains in the rooms above and the whining of the generator could be clearly heard in the quiet night.

"Either they're deaf or they didn't hear the explosion with all the noise they are making themselves," Jeff said, trying the handle on the rear door; it was unlocked. "Let us, therefore, make our presence known." He made his way into the building with Heringboot treading on his heels.

"Just on time," Jeff said cheerfully, throwing wide the door to the upstairs laboratory.

The three men in the room stood, frozen, like a tableau from a bad play. Nissing was in the process of handing over a large pile of cash to the conspirators who were both reaching for the loot at the same time. All three of them stared at the figures in the doorway with wide-eyed astonishment.

"Mr. O'Hare!" Nissing gasped. "What has happened to your clothes? I was told you had been called away."

"Full explanations in a moment," Jeff said, keeping a wary eye on black belt Scobie who was stalking forward in a half crouch, arms before him, hands ready to strike. "No, no," Jeff said in simulated terror, drawing back as the other came closer.

Scobie smiled, remembering his easy success upon the last occasion they had met and reached out his hand. The smile vanished as Jeff grabbed the hand, pressed, twisted, kicked the other man's legs out from under him as he fell, chopped him swiftly with the hard edge of his hand as he dropped and even had time to give him the knee before he hit the floor. Before Scobie could as much as groan he was prone and unconscious. Jeff smiled down at the silent figure.

"You took me off guard last time," he said. "For your information I'm black belt, too—and I picked up a few things in the Marines that they aren't allowed to teach in judo class."

Jeff said the last words as he raced across the room, and when Farquhar's hand went into the desk drawer Jeff's hand was right beside it. After a brief scuffle Jeff had the gun and slipped it into his jacket pocket. "Now we can talk peacefully," he said.

"What is the meaning of this outrage?" Nissing shouted. "What have you done to Professor Heringboot?"

"Nothing," Jeff told him placidly. "The *real* Professor Heringboot is the gentleman in the black hat there; the man I slugged was an imposter."

"Then you mean—"

"The machine is a fake and there

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is simply no matter transmitter."

"My money—"

"Has been swindled from you. That pale individual trying to edge towards the door is a well-known confidence man who has been milking marks for years."

"But . . . I saw the matter destroyer destroy matter," Nissing said as he grabbed his money from the table and began to stuff it back into his briefcase.

"Bah!" Heringboot said, folding his arms dramatically. "You saw my Einsteinian Space-Time demonstrator demonstrating. No matter was destroyed."

"B-but . . ." Nissing was shaking his head with bewilderment; he waved towards the bulk of the matter transmitter. "You were here, Mr. O'Hare, you saw the apparatus work. It transmitted my watch across the room."

Jeff smiled and picked up a wrench. "This fine piece of machinery contains a well-known stage illusion," he said, then broke the glass in the viewing window with the wrench. "Here, look inside—do you see that vertical piece of glass set in at a forty-five degree angle? That's the secret of the illusion. I'll explain: The first thing these boys did was buy a watch that duplicated yours—which was no big problem. I saw Farquhar make the shift, handing the duplicate to the now-unconscious Scobie. We watched Scobie put the *duplicate* into the back of this box. We saw it through the angled glass. Then the light over the watch slowly dimmed while the light here—on this side—slowly brightened. The second light illuminates a second box, an empty duplicate of the first that is set at right angles to it. So—darkness falls behind the angled glass which now acts as a mirror and we seem to see the watch fade from sight as it is replaced by the image of the empty box. Nothing to it."

Nissing looked back and forth between the machines, then pointed to the matter receiver. "I don't understand yet—we found my watch in that machine."

"Of course. Farquhar walked over and slipped it in while our backs were turned. Simple. The secret of all good illusions is simplicity."

"Tricked . . ." Nissing said to himself with dawning comprehension. "Swindled!" he shouted angrily and pointed at Farquhar. "You crook! Where is the twenty thousand dollars I paid you last week?"

"This sort of enterprise is not without its expenses," Farquhar said, smiling sincerely. "I'm afraid your original investment has been absorbed into operating costs—"

"Pay up you crook, or I'll beat it out of you!" Nissing advanced, fist raised, face flushed. Jeff grabbed him by the coat sleeve.

"No violence, please," he said. "With two exceptions we are all gentlemen here. I shall see to it that

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your money is reimbursed. Did these crooks at least give you any papers or agreements in return for all this hard cash?"

Nissing looked baffled. "Yes, but I don't see that that has any relevancy." He took a handsome looking legal document from his briefcase and handed it to Jeff. "Here is a patent assignment, profit agreement and all the rest."

Jeff took and examined it quickly. "Appears to be in order," he said. "Carefully drawn up, and that is Heringboot's signature in the corner. No doubt this is one of the papers he signed without reading. This satisfies me, Mr. Nissing, and I have a small confession to make to you. I am not in the investment business as I led you to believe. I am an employee of an educational foundation that is very well endowed, the professor will assure you of the truth of that. Since my foundation has been a sponsor of much of Professor Heringboot's work we feel a certain obligation in this matter. Will you allow us to help? We will pay you the twenty thousand and see how much we can get back from these con men. But, in order to justify this transaction on our books, would you be so kind as to sign over these rights that you have purchased . . . plenty of room right here at the bottom."

"Happily, happily," Nissing said, and scribbled away at Jeff's dictation and scrawled his signature.

"My check book?" Jeff said to Farquhar, who shrugged and pointed wordlessly to Jeff's attaché case lying in one corner. It had been pried open and the spool of tape ripped from the recording machine, but all the things they had taken from his pockets had been thrown in there. He pulled out his check book and pen and wrote a check for Nissing.

"Good as gold, Mr. Nissing," he said, handing it over. "Our foundation has bags of money."

"What's going to happen to these crooks?" Nissing asked, pocketing the check. "I mean, the police . . ."

"I understand perfectly, sir. Considering your new appointment as commissioner this could be embarrassing. Would you be satisfied if they vanished? Bottom of the river, concrete on the feet and that sort of thing?"

Nissing went white. "You can't mean . . . No . . . I won't be a party to it."

"What the eye does not see the heart does not grieve," Jeff said with an evil smile, at the same time rubbing his hands together with a dry, rasping sound. "Might it not be best for you to leave now and try to clear your mind of this whole matter?"

"Yes . . . of course . . . fine idea . . ." Nissing quickly clutched up his briefcase, coat and hat and swept from the room forgetting to say good-bye. His footsteps hurried down the stairs and they heard the front door slam. Jeff turned to

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Farquhar and extended his hand, palm up.

"Pay up!" he said sternly. The con man hesitated a moment, then took out his wallet and handed a pile of bills over to Jeff. "Professor, see if Scobie has any money on him while I count this," he said, flipping through the greenbacks.

Scobie's still unmoving body yielded up some more money but when Jeff counted it all there was still over four thousand dollars missing.

"Cough it up, Farquhar," he said, fixing the man with glittering eye. "You can't have spent that much on this setup. Where is it." He raised a solid fist and blew on it.

"No violence!" the con man squealed and hurried over to the desk and began to root in the back of the bottom drawer. He found what he was looking for, then straightened up with a large automatic pistol in his hand and aimed it at Jeff. "Now," he said coldly, "give me back the money."

"Two guns," Jeff mused. "I should have thought of that."

A loud crash sounded from the other side of the room as a glass beer stein appeared out of the thin air and fell to the floor. Farquhar jumped and swung the gun in that direction. Jeff plucked another beer stein out of the full box next to him and hurled it across the room. It caught Farquhar in the temple and he went over and down and out for the count.

"*Wunderschone!*" Doctor Professor Heringboot chortled and looked at his watch. "Now with the power settings from the demonstrator I can determine the temporal displacement. This must be the first sample I used . . ." His words degenerated into a mumble as he began to scratch equations on a scrap of paper.

"As I hoped," Jeff said. "You told me your invention was a space-time demonstrator that did not demonstrate any qualities of space, which leaves us with time." There was a louder series of crashes as a dozen more steins appeared and broke on the floor. "I hoped your gadget was sending the glassware through time in some fashion and I am cheered to see my deductions so well justified. These crooks could only see the machine as a gadget to work a con game—when all the time they had an operating time machine in their hands." He patted the signed agreement in his pocket. "A portion of which now belongs to CWACC, signed, sealed and delivered. A good night's work O'Hare," he said, congratulating himself since no one else was there to do it. He picked up the phone.

"All that remains now is to ring up Mannheimer and tell him that his new commissioner is off the hook. And have him pick up this precious pair and put them in the cooler for a few months. Assault

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and battery, possession of illegal firearms and such, that should do it. They won't complain—and they'll leave the state quickly enough when they're finally turned loose."

A shrill screaming split the air and an outraged cat with puffed fur and extended claws appeared in midair and dropped to the floor, howling and spitting. It darted under a workbench.

"So that's where you went, my little *schatz*," Heringboot said happily, calling to the cat. "You naughty kitty—traveling through time!"

"Mannheimer speaking . . ." the voice rasped in the phone pressed to Jeff's ear.

"I have good news for you, Sergeant," Jeff said. "Come hear it—and bring two pairs of the city's best handcuffs with you. It's been a busy night."

In the March 27, 1964 issue of *Medical Tribune*, an article appeared entitled Teenagers Found Badly Fed, Girls Worst Of All." The quotes from Dr. Hillman are taken from this article. (page 13)

This article was also read by Dr. Barnes who wrote a letter to the *Medical Tribune* telling them of his earlier study of nutrition and colds, and of the fact it had been rejected by the *A.M.A. Journal*.

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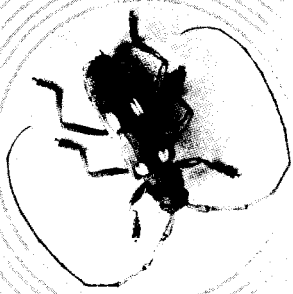

LIVE SENSORS / CARL A. LARSON

Photos courtesy of U.S. Department of Agriculture

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The men who have developed modern micro-miniaturized electronics have earned the right to feel pride in their accomplishment. But the competition is still a few dozen orders of magnitude ahead!

Our daily life is marked and gradually changed by automatic devices that test and check industrial processes, road traffic, flights and the courses of ships on the oceans. It may be true that automation is dehumanizing industry; it is certainly true that gasoline would be rather steeply priced but for the thorough automatic control of the catalytic cracking operation. True enough, computers are forcing upon biologists a language bearing no resemblance to the tongue of Aristotle, or the song of thrushes, but computers are also projecting mankind's ancient dreams into deep space. Right now microelectronic techniques produce for control systems new sensors unsurpassed in smallness, reliability and sensitivity.

Now, are these sensory devices really unexcelled? Are problems of detecting and amplifying low input signals entirely new? Could it be that such problems have been solved before, deftly and precisely, with little left to excel in the way of microminiaturization?

Today the study of sensory receptors and servomechanisms in animals is a serious proposition for systems engineers with a view to the future. Though animals use more or less refined sensors and transducers to get food and avoid enemies, the responsible systems engineer has to consider maintainability and reliability as well as sensitivity; he cannot simply imitate natural control systems. Even if he would try his hand at such imitatory invention, he would come upon rather specific difficulties, each of them shielding an unplumbed opportunity. The gist of this problem complex lies in the incompleteness of human knowledge; we have difficulties in grasping sensations which animals have and we have not and we are just beginning to learn a smattering of animal language.

Taking stock of what is known we shall first turn to mechanoreceptors, with a very brief excursion to other sensors of the body surface, and then we shall ponder the question whether the chemical senses compare favorably in sensitivity with modern analytical methods of the laboratory. We will also survey receptors for sound and light in order finally to see how animals use their sensors in closed-loop control systems, for maintenance of equilibrium and for nav-

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igation. Perhaps the extrapolation from these factual observations, with the telescope catching but a blurred segment of the offing, will be unusually precarious; anyhow, we shall try it.

Beginning with the type of sensors stimulated by mechanical energy, our inventory may as well begin close to home, the human skin registers touch, pain, vibration and pressure of diverse qualities. Young poets of the past had words for some of these patterns of pressure sensation; now it will suffice to remember that the feel of a thing has dimensions and qualities which are received and evaluated as tangible information, though we can't readily transmit the details of this information to each other.

Only a limited number of sense impressions have been tagged with names. These impressions correspond to anatomic structures, some of which have been intensely studied, but even this parallelism between structure and function is far from complete or known in every detail. This means, of course, that our doors of perception admit strangers who don't introduce themselves but make us carry out movements of which we are more or less aware.

To lift a half dollar one meter requires 1.2 million ergs; to tickle human skin by touching a hair requires 0.04 erg. This is about the scale on which live sensors receive their signals, though it is a very wide scale with human skin receptors at the blunt end.

While on the subject we may mention two other skin sensors, those for heat and cold. They are represented by special nerve-end organs which transform thermal impulses so that they can be fed into a closed-loop control system regulating the flow of blood through the tiny vessels of the skin.

These thermal receptors are just sufficient to initiate this and a few similar servomechanisms. They are placed in the skin and can thus function as exteroceptors. To this group, including sensors excited by stimuli from outside the body, belong also the previously mentioned mechanoreceptors.

But we have also interoceptors that report the state of distension and contraction of internal organs, with microscopic transducers sensing motion of the order 0.4 microns with generator potentials. We may become aware of their signals as hunger or satiety. In states of fatigue we sometimes perceive the usually mute signals for self-regulatory processes as discomfort. Entirely mute, however, are the pressoreceptors which regulate our blood pressure without ever asking our consciousness for permission or orders.

Such receptors, responding to changes within the body proper, belong to the category called proprioceptors. Some of them help us

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keep plumb. They are situated in the vestibular organ of our inner ear, in our antigravity muscles, tendons and joints.

Aside from tight-rope walking between satellites and similar top priority exploits, man has few additional worries about keeping poised; the blowfly has, however, quite a heap. Or would have if servomechanisms with first-rate sensors didn't keep flight under complete control.

Well, a real first-rate sensor for control systems design detects motions of less than 0.001 inch. The leader in the field of smallness can be mounted in a hole of 0.187 inch diameter, as we have already seen live sensors compare favorably with such industrial sensors. Insects may also use, for flight adaptation and for other purposes, servomechanisms of types we haven't even guessed at yet.

To illustrate the last point, recent observations on the behavior of flies in magnetic fields may be mentioned. The blowfly and the common housefly usually land in limited sectors around the north-south and east-west axis of the horizontal component of the geomagnetic field. When this is compensated by artificial magnetic fields, none of these preferences occur. Whoever could have guessed that flies use the interaction of circular currents with the geomagnetic field for automatic correction of their flight path? Floating a dead fly reveals the same orientation as a result of voltages between the cuticula and the body protein.

In the live animal mechanoreceptors register the minute forces arising from the interaction just mentioned. Otherwise such receptors in insects make free use of hairs to lend lever gain to imperceptible air currents. Highly specialized sensors, the arista or antenna bristles, register the drag from frontal air currents during flight, serving as a tachymeter and breeding impulses for the orientation of the antennae. Flies also use mechanoreceptors to take in the vibrations of their rudimentary hind wings. As these vibrations occur in a fixed plane, the arrangement works as a gyroscope.

Hairs also serve to detect movements in the joints of the insect scale and so breed impulses for the animal's orientation in the gravitational field. A compression of the sensor cap connected with the hair by one tenth of a micron is enough to send an impulse through a nerve fiber about 7 microns long in the honey bee. The sheath of this nerve fiber tapers to a tube of 200 Å which continues as the hair wall.

While in industry, to qualify for the prefix *micro,* a circuit has to contain at least 3 components per cm^3, it is not required that its details shall be discernible only with the electron microscope.

The point here is not that man-

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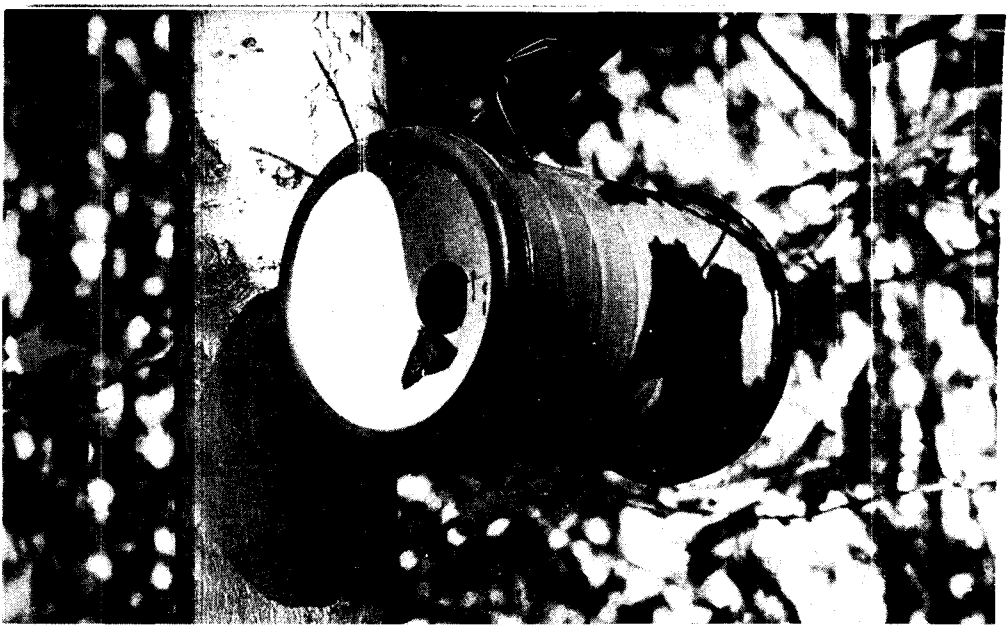

Gas chromotography has allowed chemists to achieve detection of parts-per-tens-of-millions, even parts per billion. But the flying sensing computer being lured into the trap by the sex attractant of the gypsy moth detects molecules per cubic kilometer!

made sensors are hopelessly bested by live sensors, but rather that most problems of automatic control we know of, and probably some problems we don't know of as yet, were solved millions of years ago in ways that can profitably be studied by space engineers.

Leaving the mechanoreceptors for a while we now turn to the chemical senses, asking ourselves how extremely sensitive receptors can evolve within the animal kingdom. Valid for all types of live sensors is the blunt answer that evolution is a matter not of *can* but of *must*, qualified for taste by the addition that avoidance of poison and attraction to food are required for survival.

Though such reactions inhere in organized living matter, contemporary denizens of water and dry land use more or less elaborate sensors to test solutions and separate structures to head for or turn away from them. A primitive chemical sense has been ascribed to the body surface of aquatic animals and amphibians. A pithed frog withdraws its foot from a weak solution of sulphuric acid even when cocain has blocked the reaction to scratching or pinching.

Fishes are often generously supplied with taste buds, i.e. discrete chemical sensors, on their body

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surface. The catfish has taste buds on the barbels, slender processes projecting from the snout. Aquatic animals have, of course, good reason for analyzing the fluid they swim in; we are mainly interested in what we are going to swallow. Or ought to be—insecticides are ingested without due protest and the body fat of the average United States citizen now contains measurable quantities of benzene hexachloride and dieldrin.

While such determinations can be made with great precision and sensitivity by means of gas chromatography, the human taste organs reveal a curious mixture of sensitivity, bluntness and uncertainty in operation. Quinine sulphate is tasted in a 0.00015 percent solution, but sodium chloride requires a concentration of 0.002 percent to be tasted. Both substances are temperature dependent when taste thresholds are concerned. The last figure is valid for 17°C; at 42° 0.005 percent NaCl is required.

This not being enough to confuse experimental data, in a sufficiently long series sooner or later the sweet taster for quinine sulphate pops up. Blithely clearcut results with tasting substances were obtained as long as one test person was used. Careful examinations of two persons with a number of substances usually show differences in their ability to taste dilutions of one or several of them. But when phenylthiourea, the best studied tasting substance, is concerned humanity can be divided in two groups, tasters and non-tasters for weak solutions. The proportions of non-tasters vary greatly between major populations; in Western people they constitute about 30 percent. Inherited in a recessive mode —meaning that the non-taster gene has to be present in duplicate to give rise to taste deficiency—the latter property characterizes, by its frequencies human populations, much in the same way as do blood group frequencies and has been widely used for studies in the field of physical anthropology.

Attempts to elucidate such differences in tasting ability have led to incomplete understanding of their origin. Civilized man can live with very weak taste perception. By way of example patients with familial dysautonomia largely lack the major taste buds. In this instance a series of symptoms and signs reveal disturbances of nervous functions in homozygotes for a mutant gene, combined with a notable absence of the anatomic substrate for taste functions. The inability of completely normal persons to taste moderately diluted phenylthiourea does not impair them, however, and we have to turn to special types of observations in order to trace the original importance of a keen taste perception.

To these observations belong the

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preference rats on deficient diets show for very weak solutions of the lacking substances. As far as can be understood they use their taste to differentiate such solutions from water. Further, if asked during the first five years of life we would almost unanimously vote cod liver oil a delicacy. Later, the number of children liking the once life-saving oil drops, till at fourteen only some 30 to 40 percent approve it. Now cod liver oil has been superseded by products more tasty to adults. When vitamin D is most needed, however, kids relish it even in its old-fashioned form.

Thus human chemical sensors reveal shortcomings that may to some extent reflect vanishing needs. Apparently such needs are individual, when it comes to polymorphisms. Exemplified by the division of mankind in tasters and non-tasters for phenylthiourea, the adaptive needs go deeper than what meets the tongue.

Taste is, to a largely unmapped extent, modifiable by the composition of the blood. But it is not the job of the taste buds of the tongue to savor blood. For this task we have specific chemoreceptors testing the blood of the chief arterial trunk and the two main arteries that supply blood to the head. When the oxygen content of blood decreases below the danger level, receptor impulses are transduced and transmitted to the respiratory center, which starts hyperventilation until the peril is over and the emergency activity is switched off —similar to closing the damper of a thermostat-regulated heating furnace.

It seems likely that these internal chemoreceptors are remnants of a primitive sensor system and have been kept for emergency purposes. Chemical sensors are, however, not altogether blunt and primitive. D-mannose, a simple sugar, occurs in two forms or anomers, differing only at one carbon atom where the alpha anomer has H.C.OH and the beta anomer OH.C.H; this slight rearrangement is readily detected, alpha-D-mannose tasting sweet and beta-D-mannose bitter.

Elegance and refinement in structure mark the minute taste buds which are well packed with components. Arthropods use hairs for most sensory purposes. The spiny lobster has a lot of thin-walled hairs on his antennule, supplied with nerve fibers of the microminiature caliber 0.2 micron. The insects carry chemoreceptive hairs on the mouth parts, feet and legs, antennae and egg-laying apparatus. And any involuntary student of houseflies knows they are real gourmets.

Human gourmets rely more on odor than on taste to discern flavors of which there are many, while of basal taste qualities we have only four. Then our odor world is richer than our world of taste sensations?

Yes, infinitely so. If we ask a

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This U.S. Department of Agriculture photograph makes clear what's meant by a Bug-Eyed Monster. Seems it's a Puerto Rican male cricket—and note the number of pico-miniaturized sensor. ("Pico-" is the prefix meaning micro-micro-!)

person how a solution tastes, we may get a vague answer but more likely he tells us the taste is sweet, sour, salt or bitter. If we ask him about a gas, he may tell *how* it smells, but more likely he tries to define *what* it smells, mentioning one of tens of thousands of substances, products of excretion or decay, flowers, animals and what have you. And why? Obviously because we can distinguish such a multitude of odors and fragrances that we can't possibly name them all.

As known by every male sent on his own in a bewildering world to buy a flacon of perfume, there are light scents for blondes and heavy for brunettes. If the current tinge should be forgotten the course gets mazy and buoys marked musk and lavender, jasmine and heliotrope are of no real help. For a redhead it is, of course, safe to choose civet. Now, after many previous attempts

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that have been both systematic and sagacious, a seven-letter odor alphabet may emerge and make possible a rational description of what is smelt.

This odor alphabet derives from a provocative hypothesis of olfaction launched by John E. Amoore of the Western Regional Research Laboratory in Albany, California. According to this explanation five primary odors depend upon molecular size and shape; two upon the electronic state of the molecule.

The attraction of this odor alphabet lies in the series of observational facts covered by the underlying hypothesis. Evidence that seven different receptor locks for the seven differently lettered osmic keys should exist is scant indeed but seems not to be required to make the hypothesis valid and useful. It must be added that the hypothesis became widely known only in 1964 and additional confirmation may very well be on its way.

When it comes to principles of sensor construction and function we imitate insects and use hairs to extend our olfactory sensors. These hairs measure 1 to 2 micron in length and have a diameter of 0.1 micron. They are surrounded by fluid and grow from processes of nerve cells within a limited region of the nasal mucous membrane. How airborne molecules elicit signals in the receptors is not known in detail. But, with the help of a micromanipulator, an electrode less than one micron in tip diameter can be inserted into the olfactory epithelium and the electric potentials, provoked by various olfactory stimuli in a single receptor, can be recorded through an amplifier.

Devices of this type have also been used to take EAG, electroantennograms, from insects. They smell with their antennae and they outperform most chemical analysts when it comes to tracing a minimum number of molecules.

To cite an instance, the gypsy moth female produces a volatile substance with 18 carbon atoms; a few hundred molecules per cubic centimeter of which are enough to arouse the male, who is attracted over a distance of more than two miles. This sex attractant, gyplure, is present in a single female in quantities of the order 0.01 microgram—a billion times more than necessary to attract a single male.

A unique example? No, a wealth of new knowledge has been brought to light about similar chemical signals, much of it by a group at the Max-Planck-Institute in Munich, Germany, cooperating with the Entomology Research Division, U. S. Department of Agriculture, in Beltsville, Maryland. In the latter laboratory Martin Jacobson and coworkers first isolated, then synthesized a volatile substance produced by females of the American cockroach. Of this sub-

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stance, 10^{-14} microgram is more than enough to attract the male.

In a joint report from the two laboratories where EAGs from cockroaches stimulated with the sex attractant have been presented, it is of interest to note that antennae with the almost incredibly sensitive receptors survived amputation so that EAGs could be obtained from them for several hours.

By the way, if somebody should wonder what the U. S. Department of Agriculture uses EAGs from cockroaches for, one can point to the successful application of the gypsy moth attractant first produced in the Maryland laboratory for insect control. A synthetic analog traps billions of male moths in New England, saving tree leaves and confining the gypsy moth to the area where it is already a pest.

But what about the scale of sensitivity? It is, of course, marvelous that two scores or less of a rather small molecule should be enough to provoke readable impulses in insect sensors. One point to remember is, however, that these sensory achievements do not necessarily represent an even level of extraordinary olfactory acuity. The moth female lacks, for instance, a receptor for its own lure substance. A limited number of pheromones or chemical signal substances are known to serve reproduction and, in social insects, the coordination of efforts; it is necessary for the survival of the species that individuals are tuned to receive these specific signals.

Further, with forthcoming infrared absorption techniques it will be possible to measure volatile substances in quantities as small as 10^{-5} micrograms per liter. But wait a little. Insects still lead by several orders of magnitude, without resort to plasma jets, lasers, thermocouple detectors and amplifiers. And as for compactness, give me a cockroach any time.

Before trying to draw any conclusions from the obvious superiority in some respects of animal sensors, we may consider the proposition that comparisons between industrial and satellite control systems and automatic control systems in animals are entirely misleading. Are we not speaking of two different worlds, parallel if we squint a little but lacking any real point of connection?

Well, a gas chromatograph is a quite serious proposition, indeed a sensitive and invaluable tool in all branches of analytical research. Manufacturing and selling perfumes is also a carefully calculated undertaking, and when a world-known cosmetics manufacturer furnishes a gas chromatograph with a human detector the idea can be taken to be well planned. In a series of careful experiments with an experienced perfumer for a sensor the accuracy was comparable with that of the standard de-

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This flat, ferocious-looking Bug-Eyed Monster is the click beetle. His pico-miniaturized sensors feed a computer system roughly as intricate as an entire man-made computer center.

tector. Some substances were detected by the human sensor in concentrations too low to be distinguished by the ordinary thermal conductivity detector of the instrument. For instance, methyl heptine carbonate in a few parts per hundred thousand was detected by the perfumer in one microliter samples and also identified. Here the ordinary detector was odor blind.

No, the idea of a biologically inspired technology isn't just a kink; live sensors and man-made sensors, industrial control systems and systems prefabricated by nature have much in common. The first instrumentation used to extend the range of human vision was of necessity avian. Noah sent forth a dove to see if the waters were abated from off the face of the ground. Suitably equipped termites exploring the face of the moon might not send all data needed to prepare a soft landing, but they could use equipment existing today and would not

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fret too much about the return ticket.

To return to the safer ground of recorded observations we note that termites are equipped with sensors not developed specifically to explore an extraterrestrial crust but to receive vibrations of the ground for communication purpose. On their legs they have sensors tuned to a frequency of a thousand vibrations per second. They speak to each other by delivering bursts of this frequency—knocking their heads on the ground. These specialized mechanoreceptors perceive movements of ten millimicrons.

When we receive signals of this frequency we mostly call them sound. This is one way to describe what we perceive. The stimulant is mechanical energy and in its form of vibratory motion we can, under suitable conditions, perceive it through the skin while we describe it in another way, as a whir or with some term of our own improvised making. Apparently we have little need for communication of cutaneous vibratory perceptions, but our fingertips can feel vibrations with an amplitude of one micron and even less when tested by placing the base of a tuning fork on the skin.

We have developed highly specialized mechanoreceptors to perceive vibrations with a distant source and transmitted as longitudinal pressure waves in air. This or similar requirements have been met in diverse ways by fishes, mammals and insects.

Fish use their lateral line organ to determine the direction of water currents and also to take in sonic and subsonic vibrations. We talk about subsonic or infrasonic vibrations when we don't perceive them as a continuous sound; the limit lies at about 16 cycles per second. What fish species, that hear well, mainly use for a sound receiver, however, is their swim bladder; and in some fresh water species the air bladder is connected with its sound sensors in the labyrinth by a chain of minute bones.

Now this is one way of making use of structures and mechanoreceptors that originally serve equilibration and flow orientation. By minor modifications these devices have been improved to serve sound perception. A step further is represented by the usually mute reptiles. A somewhat exceptional lizard calling itself—loudly—*gecko* has an auditory organ sketchily resembling that of mammals. At low frequencies neither man nor lizard would have to shout at the other powwowing in the gecko lingo.

Relative to human hearing that of fish is poorer but probably more adequate to environmental requirements. In urban surroundings man hears too well for his needs and for his mental balance. At 2,700 cycles per second the energy input required amounts to less than 10^{-9}

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microwatts per square centimeter.

Here we are really speaking of low input signals. Of course, higher intensities are required outside the range of 2,000 to 5,000 cycles per second; at 20,000 cps the energy necessary for perception of sound is about 40 million million times greater than at 2,700 cps.

Sound extends far beyond the range conventionally taken to represent human hearing; above 20,000 cycles per second we somewhat arbitrarily talk about ultrasonic frequencies. By feeding pulses of microwaves into a piezoelectric crystal, acoustic waves with frequencies up to twenty kilomegacycles can be produced. The physical properties of these waves are amazing. It may imply a still more important widening of human knowledge when the perception of ultrasound becomes widely studied. Human beings actually feel and hear sound up to 108 kilocycles per second when a vibrating piezoelectric crystal is pressed against the back of the neck. The threshold of perception lies about 10^{-4} watt/cm^2.

We have sensors we probably don't use and we have sensors we are as a rule not aware of. Little imagination is needed to conclude that safety margins, sometimes of considerable breadth, have more to do with past hardships than with present soft living. We retain faculties we no longer need to stay alive. It may not be equally evident that live forms now and then find themselves in possession of structures eminently useful in a specific environment.

The bottlenose dolphin is an aquatic mammal, bats are flying mammals; both swimmers and fliers use sonar and we might be bent to the stimulating conclusion that we mammals are shrewd. But emitting sounds and listening to echoes were tricks known by our forebears. When these specialized mammals emerged, perhaps as miserable cripples seeking the rocks of their refuge at shores and in dark caves, they were winnowed by selection. Bit by bit tens of thousands of generations combined the DNA programs sufficient first for survival in, then for pervasion of the new surrounding. Changed programs for embryonal development produced new structures and new tactics for hunting and mating which became fixed only when bearers of the corresponding combinations of recons, or program units, got a better than average chance of having offspring reach fertile age.

Recombination of program units in the DNA molecule is one source for newness, another is minute changes within the units of this molecule of inheritance; such changes represent mutations. Based on accumulated experience of spontaneous mutations rests the conclusion that such changes virtually always harm their bearers in

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the old enviornment of the species. They are far from invariably crippling. We must not believe that new animal forms necessarily start with monsters, but every new mutation costs a lot either in the form of deaths or in the form of relative sterility or both. When the species has paid this price and survived, as a subspecies or a new species in many instances, it may find itself suddenly, within a few million years, excellently adapted for a new environment.

Cheerful as such situations may present themselves to an evolving species they seem to force us to less cheerful conclusions regarding our chances to emulate natural control systems. We have got material for the conclusion that live sensors are, in many respects, superior to man-made sensors. Now we see why; they have been refined through natural selection in millions of years. We don't feel we have got all that time.

Everybody has heard a little about the self-directed intercepter that finds its target by jamming-resistant echolocation, rams it and fuels up from its propellants before hitting the next target in a series of 150 and more hits before returning to its base. No? This is how bats perform. They have developed specialized voice organs that produce sound of a strength reached, but not surpassed, by windjammer skippers of old—170 dynes per square centimeter. With high-pitched bursts of sound, each lasting a few milliseconds, bats localize their prey and catch it even in complete darkness, even when crossing swiftly and neatly the flight paths of numerous hunting comrades.

Here we are concerned with one special aspect of this fascinating subject, namely the extraordinary qualities of the bat's hearing. Under controlled conditions bats have been found to hear sounds up to 200 kilocycles per second. This is

In addition to several thousand eyes, the common grasshopper has scent and tactile sensors and his antennas.

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ultrasound. They avoid wires 0.4 mm in diameter and catch moths that make sudden evasive maneuvers. This indicates a sense of direction and distance of almost incredible precision.

Details about this echolocation are forthcoming and the deeper understanding of the sound receiving mechanism of bats seems not to exclude the possibility that similar devices can be produced by human invention. Much of this new knowledge stems from F. A. Webster's laboratory, where Dunning and Roeder recently turned a well-instrumented attention from predator to prey. Some moths produce ultrasonic pulses that seem to interfere with the fine-honed phonoreception of bats; it may not be completely jamming-resistant after all. Now these moths have sensors able to spot the supersonic pulses of their enemies, and so we are way down the micro scale of live sensors.

Insects use more or less specialized mechanoreceptors to hear with on the legs, where termites have slightly modified receptors for ground vibrations; grasshoppers have ears with a much wider range of perception than usually ascribed to the human hearing organ. In addition, grasshoppers and other insects hear with their antennae.

Often, in the long chain of evolutionary events, existing structures are used for different purposes. When inherited modifications of receptors can be utilized, they widen the niche and the margin of safe survival for their carriers.

In embryonal life the eyes of chicks, rabbits and human beings pass stages when they seem broadly identical; the same holds for sensory organs in more or less distantly related species. Live sensors are not only sensitive and miniaturized, but also versatile in a double sense; they are multipurpose tools, and series of deviations from basic designs admit of endless variations. Those of us who admire the wisdom of a personified Nature could as well muse on her unmitigated love for gimmickry.

As to light perception, plants and animals have widely distributed pigments of more or less identical ground composition which serve light reactions. Euglena names a genus of unicellular organisms populating stagnant waters. They have an orange-red eyespot consisting of two scores of rods packed within an area of two by three microns. Let's leave the topic of component density now; the prospects of competing with unicellular microminiaturizers look rather poor.

Euglena moves when exposed to light; in some species the eyespot is connected with a flagellum or hair-like oar propelling the organism toward or away from light—positive and negative chemotaxis. This constitutes a simple open-loop control system.

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It has been calculated that 3×10^{-11} ergs are required to elicit a response when the Euglena eyespot is exposed to light of 456 millimicron. Contrasting with this high sensitivity a much lower capacity of response limits the use of a diffuse light sense distributed over the body surface of many animals. Even internal structures, including components within the skull of fish and mammals, are photoreactive. Among mollusks, the surf clam uses a highly photosensitive nerve cell to switch off its shell closing current when exposed to light; a shadow is enough to switch on the current and close the shell.

But we were talking of discrete photoreceptors with specialized structures and specialized pigments. Some unicellular organisms possess eyespots with ultramicroscopic structures resembling the light perceptive structures of the human eye. The flatworm Planaria has two eyes with dense pigment granules shading specific sensory cells which correspond to our retina and send nerves into the animal's brain. Now we are already very far away from the simple control system directing Euglena. Keeping to the sensor components of such systems we meet in insects two types of eyes, often in the same individual, with three minute eyes or ocelli and two compound eyes as standard equipment.

The compound eyes of insects contain a highly variable number of integrated microcircuits. The fruit fly, Drosophila, has for instance 700 such ommatidia making up each compound eye. Our rods and cones have analogs in the Drosophila eye, successfully studied by J. J. Wolken in Pittsburgh, Pennsylvania, who found that these structures average 120 Å in thickness. Together they constitute a sort of retina arranged in seven radial packages of rods for each ommatidium. Similar arrangements have been found in other arthropods such as the housefly, honeybee, spider and horseshoe crab. Also from Wolken's electron micrograph investigations comes the demonstration of rod analogs composed of tightly packed tubules similar to those of arthropods in the eyes of cuttlefish and octopuses.

In the complex system for evaluating light, form, range and color that constitutes the vertebrate, eye rods are still used for photoreception. Not only are these structural principles kept with a remarkable conservatism from low life-forms to man but chemical directions valid for invertebrates are also valid for vertebrates; all visual pigment contains a particular isomer of a form of vitamin A aldehyde.

When our retina is exposed to light the visual purple of our rods blanches and it takes about half an hour of darkness or subdued light to restore the full capacity of light

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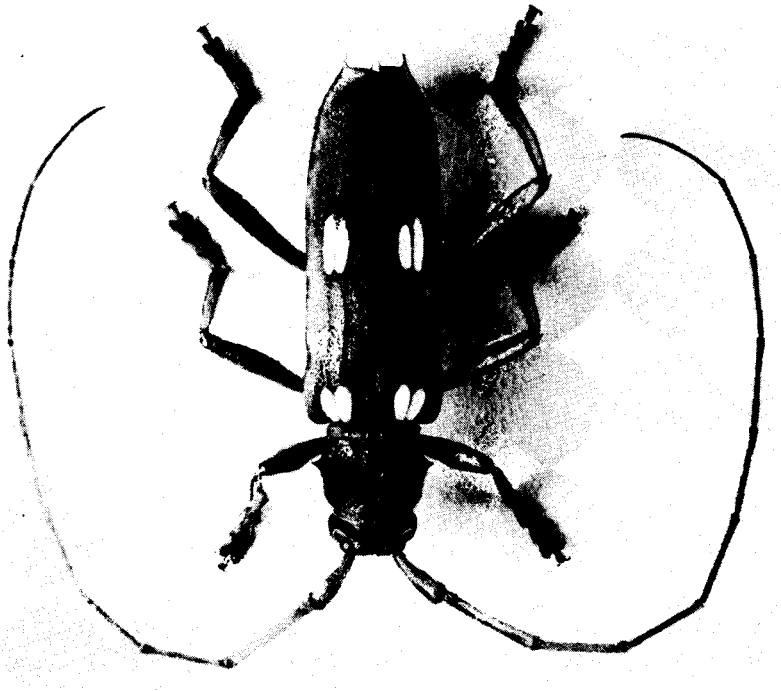
perception. Then, with the visual purple fully activated, one quantum is enough to stimulate one rod and with five rods stimulated we note a light impression. The human retina contains some 115 million rods derived from embryonal structures fitted with flagella quite like the paddling Euglena. Other flagellated embryonal cells turn into cones of which we have about 6.5 million; of these one group has its absorption maximum within the range of yellow light, another within the green and a third in the violet region.

Human dark adaptation is dependent on an adequate supply of vitamin A, nutritional night-blindness is prevented by milk fat and carrots, to mention only two sources of the vitamin and its carotinoid precursor, respectively. Other examples of decreased efficiency in mishandled receptors would have their place in a reparation manual for live sensors. They are, however, on the whole extraordinarily reli-

From the high state of development of the antennas, it's obvious the tactile sense is extremely useful to a long-horned beetle.



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able, selfadjusting and economic.

Though some applications have been mentioned, we have so far been concerned with the sensors; their ability to detect and amplify low input signals and their wide range of energizers. Pondering their fabulous economy of space and the long chain of events that created and refined them, we may draw wistful conclusion about our ability to learn from animal control systems. But let us see how live sensors feed signals into loops that direct and adjust movements.

To start with a commonplace experience, a man slips and performs a series of movements with his head, arms, trunk and legs. To the casual observer the pattern of motions may look like a cultic dance before the image of Nataraja. The performer is, however, little aware of how and why he flings his right arm to the north while carrying out a series of often very precise bending and stretching movements in his knees and hips.

The input signal comes, to simplify a really more complex pattern, from a mechanical disturbance in the labyrinth acting on the specific receptors. From them transduced signals pass through the vestibular branch of the auditory nerve to relays in the brain stem; here impulses are sent to nerves that trigger eye movements, to other nerves which start skeletal muscles moving and also to regulatory centers for muscle give. The immediate reflex action overcorrects a little so that mechanoreceptors in muscles and tendons breed new signals for precise adjustment. Vision usually plays a part in this swift and wholly automatic procedure.

We have a multitude of such control systems, they maintain our internal balance in ways analogous with those used to keep our external equilibrium. Driving vintage cars on dirt roads and flying small crafts, we use our vestibular organ in combination with scanning and horizon-finding devices of our visual apparatus to keep on an even keel. Moreover, we are exposed in such situations to centrifugal forces that generate input signals in the mechanoreceptors of skin, joints and tendons. These signals travel through closed loops with simple feedback control, but they are also fed into computerized circuits and gauged by signals from a zero-access memory we allow ourselves to believe we understand.

Now that mothers send kids to the corner-shop, with a doubloon knotted in her kerchief, to buy two micrologic cards and a flip-flop, we may have difficulties remembering that memory can be something else than aggregates of magnetic spanglets. But our zero-access is neither a magnetizable device nor the mental ability our scatterbrained neighbor complains he is beginning to lose; its trace is indelible but for destructive experiences and it responds

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swiftly and accurately to the right signals.

Though well-known experiments with flatworms, notably those performed at the University of Michigan by McConnell and his group, have contributed greatly to focus interest on Hyden's hypothesis of memory RNA, we cannot feel sure about the interpretations of these fascinating experiments. True, flatworms can learn in two ways: By training and by devouring trained flatworms. It is also true that chemical juggling with RNA can retard *and* improve memorizing. But RNA does something, it is the relay station between DNA and protein, and we know little about the part played by highly active protein molecules in memory functions. Right now the wormrunners have their sleeves stacked with trumps, not mentioned here, but the idea of distributing the professor's experience in the form of pills made from his brain substance to sleepy students is entirely unfounded on available facts; rejectable on any number of accounts and indeed unsound.*

But however these memory traces are engraved, we have them. What is worse from the angle of imitating living control systems, tiny insects and spiders barely visible have these molecular memories, plus a complete gamut of fine sensory functions, and even this is only part of the story.

To illustrate the complex and precise computerized control systems of animals we need only think of flight. What was said about human equilibrating reactions is valid for animals in flight; in addition input signals from air currents, air pressure, moisture and gravitational forces call upon the computer for evaluation and response.

Here the function of the integrated microcircuits composing the arthropod eye comes into the picture. It is just a possibility that the different spatial orientations of the submicroscopic rods in the minute photoreceptors have to do with their ability to serve as polarized light analyzers. But it is an established fact that arthropods use polarized light as a direction finder in navigation. Crabs, flies and their larvae and ants orient to the direction of vibration of polarized light; worker bees tell, with a dance the figures of which have been decoded, their comrades the direction and distance to food sources with reference to polarized light reflected from the blue sky.

The thought that we could, with existent and forthcoming techniques, imitate living control systems is not new. Analytic principles from systems engineering have been applied to animal behavior and to functions of our nervous system. In 1947 Norbert Wiener

*Dr. Larson's strong opinion here may be influenced by the fact that he is a professor at the University of Lund.—Editor.

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coined the term cybernetics; for many years the study of servomechanisms, live and inanimate, was inspired by his ideas and his personality. In 1960 J. Steele named a branch of engineering science *bionics;* it aims at the application of organismal organization to engineering. Such cross-fertilization of ideas leads unavoidably to new knowledge, much needed especially in the realm of transducer functions.

Less attractive seems the idea of using living instrumentation for industrial purposes. Noah's dove was no unique invention. Man has long used the falcon's eye and the dog's nose to extend his sight and smell. Now it is possible to keep live sensors alive and such techniques can be improved; so it would be possible to use sensory receptors from animals as components of biomechanical-electronic systems, to lead the blind, to supervise industrial procedures.

When small birds migrate they find their course by a star pattern kept in a memory not to be erased. Birds hatched in the laboratory find their way with equal security; they carry their reference pattern in the DNA molecule, the conservative carrier of inherited reaction norms. Sumerian astronomers who heard wings in the night five thousand years ago saw constellations neither more nor less unchangeable than the star patterns encoded in the thrushes' molecules of inheritance. Questions they asked, connections they sought, are our problems today, reformulated, approached by other ways, with brains which less than two hundred generations haven't changed one microcircuit. ■

THE ANALYTICAL LABORATORY *continued from page 58*

postcard listing the stories in order of your preferences is fine.

I can assure you that our authors pay close heed to your reader votes as shown in the Lab!

The readers' vote cards are scored; a vote for first place is entered as a 1; second place enters a 2, and so on so a fifth place vote adds a 5 to the story's vote total. These entries are totaled, come An Lab make-up time, and divided by the total number of votes; this gives the "point score," or average-position-rating for that story. The story coming closest to getting all-first-place votes, obviously, wins—low score means high praise. Lowest point-score takes first place, and the 1¢ bonus rate.

In the March issue, Joe Poyer most satisfied the most readers. And it was a tough fight—those were all darned good yarns! THE EDITOR

MARCH 1966	PLACE	STORY	AUTHOR	POINTS
	1. . .	Operation Malacca	*Joe Poyer*	2.02
	2. . .	Bookworm	*Vernor Vinge*	2.51
	3. . .	10:01 A. M.	*Alexander B. Malec* . . .	2.88
	4. . .	The Ship Who Mourned . .	*Anne McCaffrey*	3.36
	5. . .	Prototaph	*Keith Laumer*	3.97

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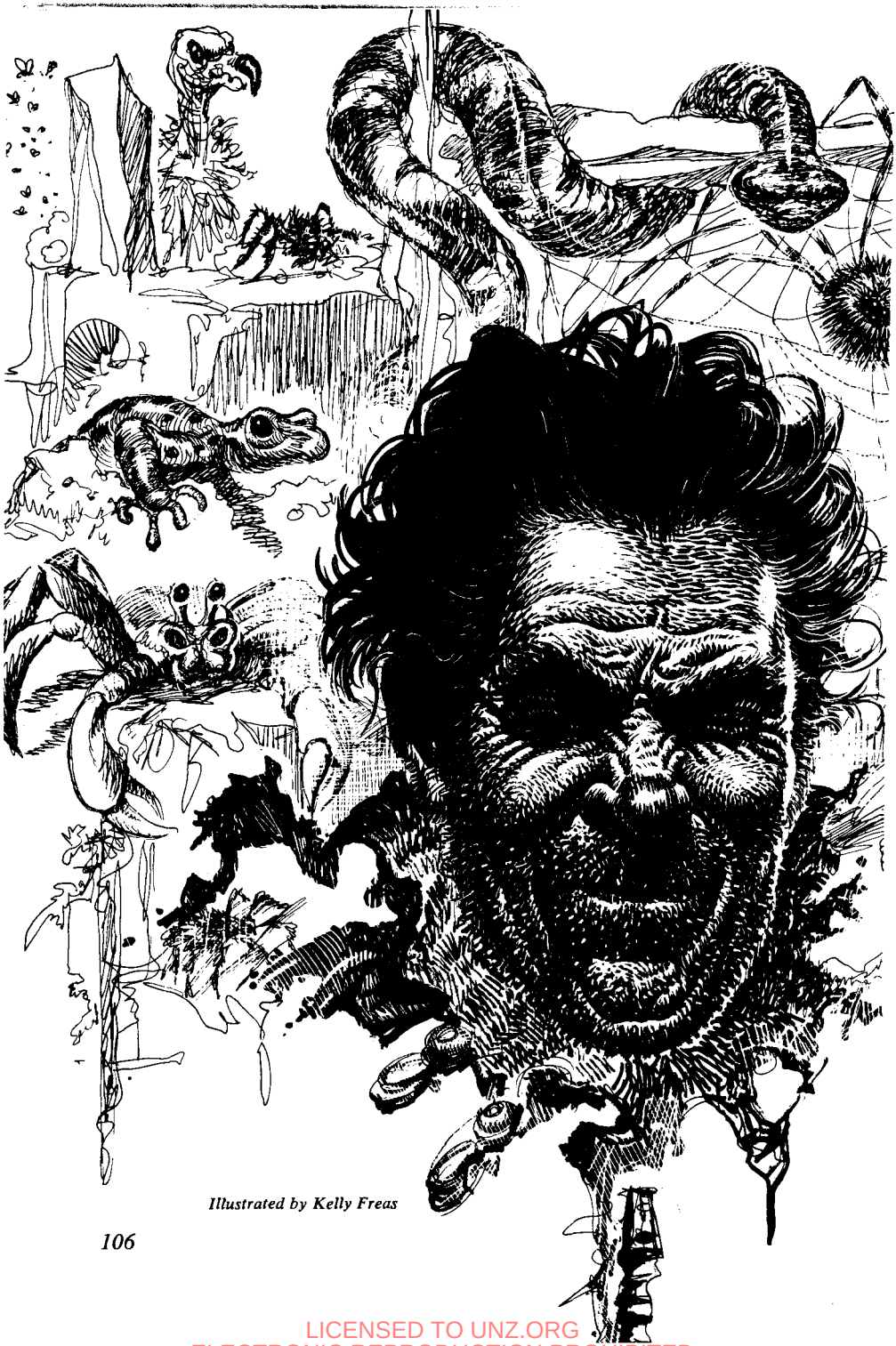

Illustrated by Kelly Freas

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STRANGLEHOLD | CHRISTOPHER ANVIL

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In investigating a new planet, there is one situation that's a lot worse than being unable to see anything.

Stellar Scout James Connely and Sector Chief of Scouts Gregory MacIntyre sat by the communicator, with the star charts spread out around them, and considered their predicament.

From the nearby communicator came a recorded voice:

"Don't land. Keep off this planet. For everybody's sake as well as your own. Stay away."

MacIntyre growled, "Nice and informative, isn't it? What's wrong with the planet? Earthquakes? Plague? Carnivores? Vermin? You'd think anyone that gets in trouble and throws up a warning satellite would have the wit to say what the trouble is. But no, all we're told is, 'Don't land. For everybody's sake. Stay away.' A lot of help *that* is."

A rapid sequence of beeps came in, and Connely said, "Well, at least we know it's Barnes." Barnes was a stellar scout who'd been missing well over a year, and MacIntyre recognized his voice.

"Yeah," said MacIntyre sourly. "It's his voice, all right, and it's his recognition signal, but he doesn't seem to have been using his brain. The thing is just a little miniature warning satellite. If he'd only followed standard procedure, he'd have put a full-size signal satellite in orbit before he went down there. Then he could have got a full-length message started back through channels the same day he got in trouble. But this thing leaves us tied in knots."

Connely nodded moodily.

MacIntyre went on, "A message like this should be relayed, without delay, straight to our HQ in this sector. That's routine. The booby trap in the setup is that the Stellar Scout Department is a part of Planetary Development Administration. This message will get distributed like lightning, so many copies to Planet Certification, so many to the Colonization Council, so many to Central Records, *and one copy to Space Force HQ in this sector.*"

"Yeah," said Connely. "I see what you mean."

"Good," said MacIntyre. "Then maybe you can help me figure it out. There are only two possibilities. Either what is on that planet *is* as dangerous as it sounds, or it isn't. In either case, you have to bear in mind that the Space Force and Planetary Development do not have the sweetest possible relationship

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with each other. If the planet *is* dangerous, it's going to look suspicious that I am out here. A sector chief hardly ever goes out on a scouting trip. I'm only here because I got tangled up with a new piece of equipment, and couldn't get loose before the ship took off. That's the truth. But it's an unlikely kind of an accident, and nobody is going to believe it. Word is going to get around that I *knew* there was trouble here, and came out to check before sending in the alarm. That's a serious offense. There will be an investigation. Regardless how the investigation turns out, the Space Force will get considerable mileage out of it."

Connely nodded. "There's no doubt about that."

"Or," said MacIntyre, "alternatively, the place may turn out *not* to be dangerous. Nevertheless, the Space Force is going to rush here all set up for a fight. Big cruisers will be roaring all over the place. Monitors will be orbiting the planet ready to knock off anything that tries to get away. They'll have the solar beam reflectors all set up ready, in case of trouble. Now, if they get all that stuff up out here, and it turns out there's nothing more dangerous on the planet than a chipmunk, Planetary Development Administration is going to be in a mess."

Connely nodded exasperatedly. In his mind, he could hear the wise commentators, and see the glaring headlines: "NO EMERGENCY" "PDA WRONG AGAIN" "SPACE FORCE CHARGES BUNGLING."

Connely could also see the newssheets that would pop out of innumerable printers in countless homes as hurried husbands bolted breakfast and read: ". . .Why was a PDA sector chief present at the scene of this latest bungling? Why does a mess like this follow right on the heels of the expensive uproar off Cygnes VI, and the disaster on Bemus III? Why must the public pay through the nose for the endless bickering and backbiting between these two monster organizations Planetary Development and the Space Force? Who is responsible? Careful analysis of the power struggle that took place at Cygnes showed without question that the local PDA official tried to mousetrap his opposite number in the Space Force. In this present instance, we actually find a high official of Planetary Development right on the spot, officiating as the misleading report was sent in . . ."

The communicator beeped again, and said:

"Don't land. Keep off this planet. For everybody's sake as well as your own. Stay away."

MacIntyre swore. "All right, Con. You see the problem. What's your solution?"

Connely shrugged. "I'm no politician, Mac. But as far as I can see, once we relay that warning, the

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mud hits the fan. After that business on Cygnes, everybody's a little —tense."

"Yeah," growled MacIntyre.

"On the other hand," said Connely tentatively, "regulations say we've *got* to relay that message." He looked at MacIntyre meaningfully. "As soon as we *hear* it, that is."

"Hm-m-m," said MacIntyre thoughtfully.

The two men looked at each other.

"Of course," said MacIntyre, "if we'd had the communicator . . . say . . . disassembled when we approached the planet, we wouldn't have heard the message."

"No," said Connely. "That's right. The message wasn't sent out till our approach triggered off the satellite."

"And then," said MacIntyre, "with our communicator out of order, there'd be no *need* to relay the message."

"Of course not," Connely agreed. "We couldn't relay it if we didn't hear it. That's common sense."

The communicator said loudly, "Don't land. Keep off this planet. For everybody's sake as well as your own. Stay away."

MacIntyre said tentatively, "Con, does the reception seem a little rough to you, as if something's going out of whack?"

"Hm-m-m," said Connely, "now that you mention it, it probably wouldn't do any harm if we took a glance at the inside of the thing, would it?"

"An ounce of prevention," said MacIntyre piously, "is worth a pound of cure. Now, let me help you get that inspection cover off."

Several minutes later, parts of the communicator were spread out generously over Connely's non-regulation gray rug.

"Probably," said MacIntyre, "when we land on this planet, just for safety's sake we ought to orbit an extra-powerful signal satellite. Then, at the mere touch of a button in the ship here, we could relay any warning—if, that is—any small warning satellite should happen to be up here. And meanwhile, if we didn't cancel it periodically, the satellite would send out its emergency call."

"Good idea," said Connely. He glanced at the clouded blue and green planet in the viewscreen. "Of course, it doesn't *look* dangerous."

"No," said MacIntyre. "And it probably isn't, either."

"Still, it's a good idea," said Connely. He went off to take care of it, relieved at the thought that the two monster bureaucracies were not about to come together in a head-on clash with him in the middle. Now it might be possible to get down to business.

A little later, they started down to the planet.

On their way down, they noted a number of small isolated villages on

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the screen, and a few fair-sized, medieval-looking cities widely scattered along the seacoast. Then Connely brought the ship down on a stretch of level grassland several dozen miles from a village built near the edge of a forest. His idea was to get a quiet look at the planet, and the natives, by sending out a few probes. Meanwhile, if there was any danger, it could hardly sneak up on the ship across that expanse of level land, and the detectors would spot anything airborne.

The ship had hardly settled down, however, when there was a noise in the corridor, and a yellow warning light began to flash. This yellow warning light told of activity by the IntruGrab, a device designed to seize intruders, and installed in the corridor, near the inner air-lock door. So far, Connely had had nothing but trouble with the IntruGrab.* Now, he looked out in the corridor to see its big globe halfway between ceiling and floor, and its metallic arms ranging far up and down the corridor.

Connely walked to the cross-corridor, saw nothing there, and decided that the IntruGrab had suffered a malfunction. He was happy to see that so far, at least, it made no effort to stuff him into the globe; but the metal arms snaking through the air around him were beginning to make him uneasy.

He was about to go back to the control room when he noticed a piece of roughly woven orange cloth on the floor of the corridor. He glanced around, wondering where that had come from, and bent to look at it.

This changed his angle of vision so that a glimpse of reflected light further up the corridor caught his attention. He stepped aside, to see, lying on the deck, a short, well-balanced dagger with no guard, and a thin double-edged blade that had been sharpened almost to a needle point. The lower third of the blade was snapped off, and lay close by. Frowning, Connely straightened. He'd had no such knife on board before, and the cloth, too, was strange. It followed that they must have come from outside. But the air lock was still shut.

Uneasily, Connely glanced around.

There was no one in sight in the corridor, but now from the direction of the control room came heavy breathing and a furious thumping sound. Connely dodged past the angled reinforcing members, and looked into the control room.

MacIntyre, a savage expression on his face, came down with both heels on a thing like a length of dull-green two-inch rope. Connely realized with a start that this was a snake, about four feet long. Just as he realized this, he felt a sensation much as if a feather pillow had been tossed lightly against his back.

* See "The Hunch," *Analog*, July 1961

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Something clattered to the floor. There was a scuffling behind him, and across the control room, the familiar yellow warning light began to flash, Connely turned, to see the IntruGrab's metal arms snatch up a gray-cloaked and hooded figure, which vanished in midair before it reached the globe. Just then, there was a grunt from MacIntyre, and the green snake went flying past Connely down the corridor. Three of the IntruGrab's metal arms grabbed the snake before it hit the floor, and stuffed it into the globe.

A flicker of reflected light caught Connely's attention, and he saw lying in the corridor another dagger just like the one that had hit his helmet earlier. This one, however, was not broken. Connely looked around for the thing that had caused the sensation of a pillow hitting his back, and then remembered that he was wearing a new item of equipment called "reflex clothing." This, like the IntruGrab, had been forced on him by MacIntyre, who firmly believed in new and modern equipment—the newer and more modern, the better.

Connely put his fist out, and punched himself in the stomach. His clothing stiffened as he hit it, distributing the force of the blow so that he felt only a light push over the front of his body. The fabric of his sleeve, however, also stiffened, to drag back against his arm, so that he found it impossible to strike as quickly as he intended. It occurred to Connely that it would be a good thing if he never had to move fast while wearing "reflex clothing."

MacIntyre was by now looking down the corridor, massaging his throat. "That snake," he said, "was a constrictor. Did you have any snakes or snakes' eggs in the storeroom?"

"No," said Connely. "And I didn't have any daggers or hooded men in the storeroom, either." He described what had happened, and MacIntyre scowled.

"Maybe there was something to what Barnes said, after all."

"Yes, and it explains why he didn't try to say just *what* the trouble was. How would he describe this?"

Connely went into the control room, and, just in case there should be large-scale trouble outside, he pushed down the lever that put the battle-computer in control of the ship. He was thinking as he did this that a planet as backward as this one appeared to be probably couldn't endanger the ship itself, and probably he and MacIntyre would know in time if it happened. But it was best to be on the safe side.

As soon as the lever was pushed all the way down, however, the gravitors gave a howling whine, the accelerometer needle whipped around its dial, and the scene on the outside viewscreen jumped backwards and melted into a blur.

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The communications screen cut into the battle-control circuit, and lit up to show the green image of the ship hurtling toward a blocky turreted structure like a medieval castle. From this structure, the battle screen showed peculiar wavy lines and ghostly whitish blurs moving out toward the ship. From the ship, in turn, a set of yellow missile tracks, and dazzling bolts from fusion guns slammed out at the massive structure. As the ship flashed past, Connely quickly reset the viewscreen. He saw walls and towers erupt in boiling clouds of dirt and masonry. The ship now flipped end-for-end, with a tortured whine from the gravitors, raced back, and hit the remains of the structure a second time on the way past. The ship then landed, in almost the same spot where they had set down originally.

Connely, dumbfounded, looked at MacIntyre. MacIntyre pulled his jaw shut, and glanced at Connely with a blank expression. Connely shook his head, studied the viewscreen, and was rewarded by the sight of an empty expanse of grassland. Thinking it might be possible to get a better view from one of the ship's upper turrets, Connely went up a ladder, and slid back the armor plating from the transparent dome.

A thing about eighty feet long, with teeth as big as elephant's tusks, sprang at the ship. A snake shaped like a boa constrictor, and about the size of a sea serpent, thrust its snout at Connely like a battering ram.

Connely almost fell down the ladder in his haste to get out of the turret. He only barely had the presence of mind to hit the switch that would throw the armor back over the turret. He sprang to the controls, and then it dawned on him that the battle-computer would long since have finished off any such things as he had seen. And if it hadn't, the sheer weight of the blows would be knocking the ship around by this time.

He glanced at the viewscreen and saw merely the empty expanse of grassland. He stared at this a moment, then went back up the ladder and pulled the armor away from the turret again. The ground outside was now acrawl with waves of spiders the size of a man's hand, that climbed up on the ship and began to spin a web of white strands from ship to ground, fastening the ship down with a thick white membrane that grew thicker and tougher as he watched.

Connely automatically reached for the hand controls of the fusion gun in the turret, and then paused. He climbed down, and readjusted the viewscreen, which showed him the same view of empty grassland. He climbed up and looked out the turret. He saw big whitish sheets and cables now covering the ship, and being drawn taut by other cables that ran off to the side. As he watched, the hull of the ship began to warp and buckle.

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Connely dropped down the ladder and sprang to the viewscreen. There was nothing but empty grassland. He realized suddenly that there had been no feeling of motion, and no sound from the plates of the ship. If the ship were being squeezed like that, there would be movement, and loud creaks and groanings from the bending metal.

MacIntyre, who'd been watching with growing amazement as Connely hurtled up and down the ladder, said abruptly, "No offense, Con, but would you mind telling me what the devil you're doing?"

"Go up to the turret and take a look," said Connely.

MacIntyre grunted and went up the ladder. An instant later, his voice carried down from above, and he shot down the ladder to make a flying jump for the control board.

Connely leaned casually against a bulkhead in the control room, and watched as MacIntyre grabbed at the controls, then froze halfway, and stared at the viewscreen. He shifted views several times, then glanced at Connely, turned and went back up the ladder. While he was up there, Connely walked back into the corridor, to see if the second knife that had been thrown at him was still there. He found it lying where he had seen it before, and noted again that it was a very narrow-bladed knife, apparently balanced especially for throwing, and designed to penetrate flesh with the slightest effort.

There was a faint hum as the armor slid back over the turret, then MacIntyre was standing beside Connely, who straightened up from the knife, and said, "The more I see of this planet, Mac, the more I have to agree with Barnes."

"Yes," said MacIntyre. "Me, too. And speaking of Barnes, I wonder where he landed?"

"I don't know," said Connely, "but we ought to be able to find his ship. And we might just as well start looking now."

MacIntyre nodded. His face had an unusually thoughtful expression as they walked back into the control room, and Connely lifted ship.

Once they had a reasonable altitude, Connely released several probes that flashed away on predetermined courses. As the ship streaked north, more probes dropped out. A little over an hour had gone by when a red light lit up on a small panel, to show that Probe 6 had spotted something that matched the taped description of Barnes' ship. Connely sent out the signal to recall the others, and then studied on a small auxiliary screen the image sent back by Probe 6.

The country where Barnes' ship had set down was rolling grassland, much like the place where Connely had landed. Here, too, there was a village a few dozen miles away, which suggested that Barnes, like Connely, had hoped to take a quiet look at the people of the planet,

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but didn't want to frighten them away, or make a sudden dramatic appearance that would upset their lives. Connely smiled sourly at this last thought. The native inhabitants of this planet were apparently well able to take care of themselves.

As Connely was thinking this, the gravitors whined, and another massive structure of high slit-windowed towers and walls appeared on the screen. This one was made entirely of black stone, and as it enlarged on the screen, it rapidly took on the brooding, foreboding aspect of a vulture perched on a tree limb. A sense of dread gripped Connely. The outlines of the control room seemed to waver and run around him, like a sketch drawn in washable ink and placed under water. Then abruptly the illusion was gone, and the outside viewscreen showed a towering column of dust and debris rolling skyward where the structure had stood. The sense of dread was gone as if it had never been.

MacIntyre said suddenly, "Look at this screen!"

Connely glanced at the auxiliary screen, to see a ragged scarecrow figure dancing and waving its arms by Barnes' ship.

"That," said MacIntyre, "looks like Barnes, to me."

When Connely brought his ship down, the figure was still there, and now they could see that Barnes' eyes were tightly shut. The wild waving of his arms that they had taken for happiness at the thought of being rescued turned out instead to be a violent shooing motion, as if Barnes were trying to warn them away.

Connely said, "Before we open the hatch, it might be worthwhile to see what this place looks like from the turret."

"Yes," growled MacIntyre, studying Barnes' thin worn face. "Meanwhile, I'll run out the loudspeaker and pickup and see if he can tell us anything."

Connely climbed into the turret, ran back the protecting armor, and looked at a scene out of a madman's nightmare. The rolling grassland, which showed up as an empty stretch of ground on the viewscreen, appeared to be filled with a maze of tall moss-covered stone walls cut with large rectangular holes like window-openings and doorways. In the oversize doorways lay huge snakes, big crabs with oversize claws, and semifluid horrors like giant jellyfish. The window-openings were closed by big spider webs, or partially blocked by gray cone-shaped nests of hornets and wasps. A brief glance was enough for Connely, who looked away before the scene etched itself any more sharply in his memory.

From below came MacIntyre's voice, as he spoke into the loudspeaker.

"Can you hear me all right, Barnes?"

"Go away," came a rough voice.

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"Get out of here before they get you, too."

"Can you get around to our air lock?"

"Are you insane? I can't go anywhere through this stuff."

"What's wrong? Why can't you get here?"

Connely said, "He can't, Mac. There's an illusion of big walls, boa constrictors, giant crabs . . . Open your eyes on that sight, and you'd be afraid to take three steps."

"It's more," came Barnes' voice. "It's not just a visual illusion. It's tactile as well. You can touch it, feel it, smell it. It can grab you, block you, flatten you. Whatever you do, don't leave your ship or open up the air lock."

"What's wrong with your ship?" said MacIntyre. "Can't you go back inside, and lock up?"

Barnes gave a short laugh. "My ship? Where is my ship? Do you see it?"

MacIntyre hesitated an instant. "It's right behind you," he said.

"You see it?"

"Yes, in the viewscreen."

"Ah, the viewscreen," said Barnes. Then he added matter-of-factly, "Yes, I suppose the viewscreen picks up the basic physical reality, and doesn't show the rest. But to me, there's a low hut back here, and that's all. You say that's the ship?"

MacIntyre said, his voice somewhat desperate. "The ship's right behind you."

"*You* say so," said Barnes musingly, "but what's reality, anyway? Only an illusion that fits all the senses. How do I know what's true for you will be true for me?"

"Truth's truth," said MacIntyre sharply.

"It may be so on Earth," said Barnes. "It isn't so here. Truth is the image imposed by the stronger mind on unformed matter. Truth changes. It's changed several times since I've been here. Once, while it was in flux, I got up a satellite. At least, I think I did."

"You did," said MacIntyre. "Now stop this nonsense about truth, and get ready to climb into the ship. I'm going to move over closer to you."

The ship lifted and moved gradually closer to Barnes. Connely looked warily out the turret, his eyes only partly open, to see the apparently solid stone walls seem to compress and slide around the ship as it moved forward. Barnes came into view, and behind him, a low thatched hut. The ship stopped within several yards of Barnes, and MacIntyre said, "Con, are we close enough?"

"It looks so to me," said Connely.

"O.K., Barnes," said MacIntyre. "Climb in."

Barnes stepped forward with his hands outstretched and his eyes tight shut. He came in under the curve of the ship, out of Connely's range of vision. Connely heard him say wonderingly, "I feel it."

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A few minutes later, there was the sound of the outer air lock door coming open. Then the sound of it going shut. MacIntyre said, "Can you hear me, Barnes?"

"Yes," said Barnes. "I hear you."

"I'm going to douse you with disinfectant. It's new stuff, and it's death on germs, but try not to swallow any of it."

"All right."

Connely slid the armor back over the turret, and dropped down to the control room. He snapped off the microphone connection to the wall speaker in the air lock.

"Are we *sure* this is Barnes?" he said. "From what I've seen of this planet, I'd hate to take a disguised native on board."

"You've got a point there," said MacIntyre. "He *looks* like Barnes. But, how—"

Connely nodded sympathetically as MacIntyre looked perplexed.

"Well," said MacIntyre, "we don't have records of fingerprints or retinal patterns handy, but I *may* be able to find out if that isn't Barnes." He snapped on the microphone, and said in an excessively cheerful voice, "You getting a good wash-down in there?"

A gargling sound came back at him. A few moments later, Barnes' voice said, "Ye gods, what awful stuff!"

"It's the new disinfectant I was telling you about," said MacIntyre. He added positively, "It's much better than what we used before."

There was a little pause. Then Barnes' voice said shortly, "Yeah."

"When we get you back," said MacIntyre, "I'm going to completely refit your ship. The fact that you couldn't handle the situation here shows how out-of-date your equipment is."

There was a considerable silence, then Barnes' voice said, "Listen, Mac, I appreciate your getting me out of that mess. But before we go through that business about refitting the ship again, would you mind letting me out of this air lock? Your improved disinfectant is eating patches of skin off my feet."

"I'll give you another rinse," said MacIntyre. Then he snapped off the air-lock speaker and glanced at Connely. "I can't swear that's no native. But he sounds like an Interstellar Scout to me."

Connely nodded agreement, and went to get a fresh uniform for Barnes.

About fifteen minutes later, the lanky Barnes was slumped in Connely's control seat, his arms and legs jutting out of the too-small uniform. Barnes looked worn, thin, and somewhat out of sorts after being snatched up by the IntruGrab and put into the globe with the dead snake.

"Listen," said MacIntyre pugnaciously, "*I* spent the first part of the trip in there. If *you* can't take a few minutes of it, that's tough."

"Go on outside for a few months

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first," said Barnes irritatedly. "See how you like it then."

"If you'd used your equipment properly," said MacIntyre, "you probably wouldn't have got into that mess in the first place."

Barnes glanced at Connely. Connely had never met Barnes before, but in that moment they seemed to be brothers. Connely said sympathetically. "What happened?"

Barnes drew a deep breath. After a moment, he said, "Well, to begin with, I took a rough survey of the planet, and decided it was harmless. I tested the air, ran through all the usual checks, and then I was *convinced* it was harmless. I should have put a signal satellite in orbit, but I only had the new model, and for some fool reason, it wouldn't transmit. Still, I wanted a look at the place. So, like a jackass, after I came down I got out of the ship to take a walk around."

MacIntyre growled, "Unarmed?"

"No, not unarmed. Among other things, I had on your good-for-nothing reflex helmet and clothing. I also had on your worthless M1-X Gazelle Boots, and in addition I had your new Self-Draw Matter-Displacement gun strapped to my waist."

"Then," said MacIntyre, looking puzzled, "you were ready for anything."

"Except the weapons," said Barnes.

MacIntyre frowned. "What weapons?"

"My *own* weapons," said Barnes angrily.

There was a lengthy silence as the two men glared at each other. Connely leaned back, ready to enjoy the spectacle of somebody else fighting with MacIntyre for a change. After a brief glaring contest, Barnes said furiously, "Why don't you try all these things out first, prove them, and go slow about putting every maniacal contraption that comes along into the ships?"

"Join the Space Force," snapped MacIntyre.

Barnes turned red, sucked in a deep breath, and rose half out of the chair. MacIntyre balled his fists and leaned forward. Connely glanced around nervously at all the instruments that might get smashed up.

Apparently, the same thought occurred to Barnes and MacIntyre, who glanced pugnaciously around, and then by mutually graduated stages, that were a little hard for a bystander to follow, slowly subsided into their seats.

Connely tried to get the conversation back on its tracks. "What happened after you went out of the ship?"

Barnes blinked, and looked around as if he'd forgotten where he was.

"Oh," he said. "Well, till I got about thirty feet from the ship, *nothing* happened. Then there was a growl, I turned around, and a thing much like the Hound of the Baskervilles, was coming straight for

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me, from the direction of the ship."

"What did you do?"

"The first thing I did," said Barnes, "was to make the mistake of starting to reach for my gun. *Bang!* It slammed out of the holster into my hand and fired itself. The animal was almost on me by this time, and I hadn't wanted to shoot for fear I'd put a hole through the ship, which was right behind it. Rather than risk another shot, I made my second mistake, and pressed down on the toes of the Gazelle Boots, like you're supposed to if you want to go somewhere in a hurry."

Connely had never heard of Gazelle Boots before, and cast a questioning glance at MacIntyre. MacIntyre refused to meet his gaze, and looked off noncommittally at a corner of the control room. This told Connely that Gazelle Boots were one of those items on which production had been "temporarily suspended pending further study." If the boots had still been in production, MacIntyre would have looked back with stern righteousness.

Barnes said, "The left-hand boot took off in a hurry, but so did the right-hand boot. I landed flat on my back, and this animal bounded over my head. Well, I couldn't wait to get on my feet, but in my hurry, I couldn't keep from pressing down on the toes of the boots before I got up. Every time I did this, the boots went somewhere fast, and I bounced and dragged along after them. The animal's jaws were snapping shut half an inch from my face, and I was in a terrible state by the time I managed to get to my feet. I barely had the wit to press down alternately heel-and-toe, according to the directions for walking in Gazelle Boots, and then the boots really streaked out fast. But the reflex clothing froze up like cast iron every time there was any sudden stress on it, so I *couldn't* move my legs fast, and at the same time I *had* to, because of the boots."

Connely shook his head sympathetically. "Then what?"

"The boots almost snapped my legs off at the ankles. I ended up on the ground again, and the monster dog was all over me. I was firing at it, and couldn't seem to hit it. Then suddenly the dog was gone, and a voice somewhere was talking some kind of foreign language. The meaning seemed to form in my head at the same time as the foreign words that I couldn't understand."

Barnes shook his head in reminiscence, and after a little silence, MacIntyre said, "What did the voice say?"

"It said, 'Why, this fellow is a mere beginner. He's got his spells crossed.' "

MacIntyre looked blank. "Did it say *'Spells'?"*

"That's what it said."

There was another silence, and then MacIntyre said, "Then what happened?"

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"That was it," said Barnes. "The dog was gone. I went back to the ship and discovered that the first shot from the matter-displacement gun had taken a chunk the size of a beachball out of the outer hull and frame of the ship. Before I could repair it, everything changed to look the way it looks out there now."

Connely said, "But what happened after that? I mean, what did you do?"

"What *could* I do? Once I was stuck there, with those monstrosities staring at me from that wall, I didn't do much traveling, I can tell you that. And I couldn't work on the ship, because I couldn't see it, or feel it. Then a stream of visitors began to come, and I discovered that I was a curiosity. Some of them tried to teach me the language, which they said I had forgotten completely because of mental shock. I think they all looked over the ship while they were around, although I couldn't see the ship myself, so I couldn't be sure. Pretty soon, an argument started between a couple of factions of these visitors.

"As nearly as I could figure it out, one side claimed that I had made the ship and other devices myself, subconsciously, but didn't have the conscious skill to operate them. The other faction claimed that the whole thing was a hoax, engineered by Aloom, or someone with a similar name. They quizzed me on the subject, and when I learned enough of the language to tell them the plain truth, they had a big laugh over it.

"Then each side claimed that what I'd said proved their theory. One side claimed that it showed that I was a basically irrational sort of person who relied on intuition rather than reason, and as everyone knew this meant that I would tap the subconscious more easily. The other side said that the illusion was too detailed to be the work of an irrational untrained mind. The whole illusion must have been impressed on me from outside. This argument got hotter and hotter, and the insults flew back and forth, and all I can say is, I'm glad they didn't forget to feed me now and then."

MacIntyre said, "They had a fight?"

Barnes nodded. "There was thunder and lightning—or seemed to be—earthquakes, tornadoes, and all kinds of natural disasters. The sky was black for a solid week one time. I don't know how to describe it. At any rate, now and then things would go into a state of flux, the walls would seem to run like glue, and then they would form again with a different arrangement. Not *much* different, but enough so you could notice it. I think what it meant was that one side had wrested mental control away from the other side. While this was happening, I could get a wavering view of the ship and grassland around it."

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"In other words," said MacIntyre, frowning, "their illusions canceled each other out?"

"Maybe," said Barnes. "Or maybe, when they nullified each other, I was able to impress my own picture of reality on the scene."

MacIntyre shook his head violently. "It wasn't all illusion. Truth is things are as God sees them."

"Sure," said Barnes, "but can we see things that way?"

The discussion was making Connely uneasy. To try to get it back into some familiar channel, he said, "We had a few strange experiences ourselves, right after we landed, and before we put the battle-computer in control." He told Barnes about the snake and the dagger, and added, "It seems like a fair conclusion that the people on this planet have highly developed psychic powers."

"I suppose that's it," said Barnes. "Whatever they've got, it's no fun to tangle with it."

Connely looked at MacIntyre. "What do we do about a planet like this?"

"The first thing is to get off it. See if we can drag Barnes' ship up with a gravitor beam, and then put some space between the planet and us." He frowned as he said this, and it occurred to Connely that MacIntyre's problems would not be over once they got off the planet.

MacIntyre put this into words himself after they'd got Barnes' ship up, and were in orbit well out from the planet. "This," he said sourly, "is a real, first-class mess."

Connely nodded, but Barnes said, "Why? It looks like a simple 'No Landing-No Colonizing' job to me. We put the warning satellites in orbit, notify Planet Certification, and let it go at that."

"Fine," said MacIntyre. "And just what *reason* do we give?"

Barnes opened his mouth, then shut it again. "Hm-m-m," he said. "Well, that is a problem."

"The authorities," said MacIntyre, "don't believe in psychic phenomena. Here we've got a whole planet full of psychic phenomena. Now, what do we do?"

Barnes said hesitantly, "You're a sector chief, Mac. They'd believe *you*, wouldn't they?"

"They'd believe I was in need of a rest cure. I wouldn't believe this myself, if I hadn't seen it."

The three men were silent a moment, then Connely said, "Suppose we brought back proof?"

"*What* proof? The viewscreen didn't show what we saw outside. Therefore the records won't either."

"All right. But what about the snakes, the knives, and the man that appeared in the corridor out there. *They* were real. And we've got the dead snake and the knives."

"Sure, but how do we prove where they came from? Just suppose we had visual records of the whole thing. It *still* wouldn't prove

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anything to anyone else, because it could have been faked. And if we got a record that *couldn't* possibly be faked by present techniques, it would merely show that we'd developed a clever new technique in advance of the times. The only way that we could convince the authorities would be to bring them here. How do we do *that?"*

The minutes crept past as the three men groped for an answer to this problem. In due time they ate, and then retired to Connely's small cabin, just off the control room. MacIntyre settled in the armchair, Connely sat down at the desk and tilted back the chair, and Barnes stretched out on the bunk. Time crept past. Connely, unable to bridge the gap between unyielding authority and unblinkable fact, found himself drawing a sketch of maniacs gibbering from behind iron bars. Suddenly, as he looked at this sketch, it seemed to mean something. He pulled over another piece of paper and began to write:

TOP SECRET

To: Sector GHQ

Planetary Development Authority

Subject: Acute Infectious Insanity

Sirs:

We enclose herewith the official logs of Stellar Scout Ships 82 and 87. On the dates mentioned in the logs, the following events took place:

a) Scout Ship 82, after a routine planetary inspection, was landed by Stellar Scout J. R. Barnes, on the planet identified in the coded data sheet enclosed. Taking normal precautions in the absence of any visible danger, Barnes left his ship to observe the planet at first hand. Though thoroughly experienced in his work, and well armed, he experienced the following subjective phenomena: 1) attack by a large doglike animal, which was unaffected by Barnes' weapons, and which later vanished; 2) a voice, though no visible person was present; 3) alteration of his surroundings, the ship becoming invisible; 4) visitation by mysterious local inhabitants, who became engaged in a violent controversy caused by his (Barnes') presence; 5) imprisonment by the said local inhabitants.

b) Stellar Scout Ship 87 was landed on the same planet by Stellar Scout James Connely, accompanied by Sector Chief of Scouts Gregory MacIntyre, who was on board to inspect the functioning and operation of new equipment. Although neither man left the ship at any time while on the planet, they experienced the following subjective phenomena: 1) Sector Chief MacIntyre believed himself attacked by a snake of moderate size, which attempted to choke him by constriction; 2) Stellar Scout Connely believed himself attacked twice with thrown knives; 3) both men observed, through the forward fusion turret, realistic illusions of objects, external to the ship, which did not appear on the outside viewscreen.

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Full details of these occurrences are enclosed in the accompanying report.

In explanation, it is suggested that the three men were, during their landing on the planet, rendered temporarily insane by the action of some unknown highly-infectious agent or agents.

Although this condition subsided promptly upon leaving the vicinity of the planet, it is clear that the planet should not at the present time be opened to colonization and development. Warning satellites have, therefore, been put in orbit about the planet, according to the regulations concerning medically-dangerous planets.

MacIntyre read the paper carefully. "I think you've got it, Con! They can *accept* this. And, of course, once they do, they'll be bound to *investigate* it. Meanwhile, in the more complete report, we can put enough information so anyone who can understand will see what actually happened."

Barnes read the paper and nodded approval. "Better that *we* suggest we were temporarily nuts than that *they* think of it."

Connely said, "It's too bad we can't just say what actually happened."

MacIntyre nodded. "Still, it's always this way. We've got a science-based civilization, and if psychic phenomena occur, they're either rationalized away, or denied outright. It's as if science were somehow *allergic* to psychic phenomena, like a hay-fever sufferer who can't stand ragweed. Although why that should be, I don't know."

Barnes said, "I can answer that one, Mac. When I was stuck on that planet, as I said, some of the natives tried to 'reteach' me their language, which they thought I must have forgotten. I got good enough at it so that they could understand me, and I tried to explain what had actually happened. One day, they told me how they *knew* my explanation couldn't be the true one."

"How?"

"Well, they said, at the base of my argument was this thing I called 'science.' And 'science' they said, was a transparent impossibility, because it was built on an assumption that was provably false."

MacIntyre frowned. "What assumption is that?"

"That experiments can be repeated, and give the same results at different times and for different investigators."

"They don't believe that?"

"No, and what's more, to *prove* it wasn't true, they followed my instructions and got some copper wire and magnets, had a small compass made, and then passed the magnetic field through the wire, using the compass to detect the induced electric current. They carried out a series of experiments, in which the current flowed *in either direction or not at all,* as they wished."

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MacIntyre whistled. Then he said, "Oh, you mean, they made that *illusion*."

"I don't think it *was* an illusion, Mac. I think their psychic control was strong enough to reverse a weak current flow caused by a weak electromotive force. But regardless whether it was an illusion or not, the result was the same: to make a perfectly good experiment worthless. Can you imagine trying to develop science on a planet where, so far as you can tell with your senses, the same experiment gives you one result on Tuesday, and another on Wednesday, depending on your own or somebody else's attitude? On this basis, science could never even get started."

"Yes," said Connely, "but wait a minute. The whole point of science is that the experimenter is *disinterested*. He comes to Nature, and puts the question. Whatever answer Nature gives, he accepts, and then goes on from there. These natives of yours didn't have the right scientific attitude."

"I'll say they didn't," said Barnes. "They *willed* the current to go one way or the other."

"All right. Get them to suspend use of their psychic powers, hold the right mental attitude, and experiments will work for them, too."

"Sure," said Barnes. He glanced around at some inexpensive novels Connely had brought along, pulled one out, opened it, and handed it to Connely. He put his finger beside one of the lines and said, "Look at that."

Connely glanced at it:

". . . at him furiously. She cried out, 'If you do, I'll . . .' "

Connely nodded. "I see it. What of it?"

"Look at it. *But don't read any of it.*"

Connely tried it, and said, "The only way I can do that is to unfocus my eyes. Otherwise, if I see it, I've read it."

Barnes nodded and closed the book. "There's the trouble the natives have. Once you do something automatically, how do you *not* do it? They've probably been exerting psychic influence all their lives. They can no more suspend it and take up a proper scientific attitude than we can glance at a line of print without reading it."

MacIntyre said, "Speaking of a 'proper scientific attitude,' I have doubts that many of our own scientists are 'disinterested observers,' anyway. It strikes me there wouldn't be much experimenting done if they were."

"Maybe so," said Barnes. "But that doesn't matter so long as they don't have, or for whatever reason don't exert, enough psychic influence to affect the result. And the schools, with their standard experiments, would tend to screen out at the beginning those who didn't get the usual results, for psychic reasons or otherwise."

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"So," said MacIntyre frowning, "what we end up with is that a scientific civilization just naturally inhibits the development of psychic phenomena, and a 'psychic' civilization just naturally inhibits the development of science. So whichever one gets a big enough lead tends to get a stranglehold on the other one."

"Right," said Barnes.

MacIntyre sat silent for a long moment, thinking it over. Finally he said, "Well, all we can do is send in that report. But first, we'd better get your ship fixed, and get started back."

Barnes got up. "The sooner we get out of here, the better, as far as I'm concerned."

They went into the control room, where Connely took a long look at the viewscreen, "Boy, whoever gets put in charge of investigating 'acute infectious insanity' has some jolts in front of him."

Barnes nodded. "But bear in mind, down there they're just as bigoted and pig-headed about science being impossible, as people are elsewhere about psychic phenomena being impossible."

Connely said, "And that will just make it all the worse when the two sets of know-alls come together."

"It will be a real mess, all right," said Barnes.

MacIntyre was beginning to smile. "Oh, I don't know about that. It strikes me as plain justice. You could even make a saying out of it."

"Such as what?" said Connely, looking doubtful.

MacIntyre smiled.

"One good bigot," he said, "deserves another." ■

IN TIMES TO COME

The lead novelette next month is "The Message," by Piers Anthony and Frances Hall. It's extremely hard to say anything about the yarn—which is a little dilly of a trick!—without giving away some of the gimmick. But this bit of science-fiction gimmickry has nothing whatever to do with higher physics; it's more a matter of the proposition that a *really* effective linguist is, after all, a man who can get the message *he wants to convey* across, to produce the effect he needs to produce.

This can be quite difficult when the other guy has you completely hog-tied, boxed for shipment, and isn't in the slightest interested in what *you* want . . .

But for a real linguist, there are ways . . .

THE EDITOR

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Escape Felicity

Anything an intelligent entity encounters,
he must interpret in terms known to him.
Which produces some major
misunderstandings when he encounters something
beyond experience—or belief!

FRANK HERBERT

Illustrated by Kelly Freas

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"An escape-proof prison cannot be built," he kept telling himself.

His name was Roger Deirut, five feet tall, one hundred and three pounds, crewcut black hair, a narrow face with long nose and wide mouth and space-bleached eyes that appeared to reflect rather than absorb what they saw.

Deirut knew his prison—the D-Service. He had got himself rooted down in the Service like a remittance man half asleep in a hammock on some palm-shaded tropical beach, telling himself his luck would change some day and he'd get out of there.

He didn't delude himself that a one-man D-ship was a hammock, or that space was a tropical beach. But the sinecure element was there and the ships were solicitous cocoons, each with a climate designed precisely for the lone occupant.

That each pilot carried the prison's bars in his mind had taken Deirut a long time to understand. Out here aimed into the void beyond Capella Base, he could feel the bars where they had been dug into his psyche, cemented and welded there. He blamed the operators of Bu-psych and the deep-sleep hypnotic debriefing after each search trip. He told himself that Bu-psych did something to the helpless pilots then, installed this compulsion they called the *Push*.

Some young pilots managed to escape it for a while—tougher psyches, probably, but sooner or later Bu-psych got them all. It was a common compulsion that limited the time a D-ship pilot could stay out before he turned tail and fled for home.

"This time I'll break away," Deirut told himself. He knew he was talking aloud, but he had his computer's vocoders turned off and his absent mumblings would be ignored.

The gas cloud of Grand Nuage loomed ahead of him, clearly defined on his instruments like a piece of torn fabric thrown across the stars. He'd come out of subspace dangerously close, but that was the gamble he'd taken.

Bingaling Benar, fellow pilot and sometime friend, had called him nuts when Deirut had said he was going to tackle the cloud. "Didn't you do that once before?" Bingaling asked.

"I was going to once, but I changed my mind," Deirut had said.

"You gotta slow down, practically crawl in there," Bingaling had said. "I stood it eighty-one days, man. I had the push for real—couldn't take any more and I came home. Anyway, it's nothing but cloud, all the way through."

Bingaling's *endless* cloud was growing larger in the ship's instruments now.

But the cloud enclosed a mass of space that could hide a thousand suns.

Eighty-one days, he thought.

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"Eighty, ninety days, that's all anyone can take out there," Bingaling had said. "And I'm telling you, in that cloud it's worse. You get the push practically the minute you go in."

Deirut had his ship down to a safe speed now, nosing into the first tenuous layers. There was no mystery about the cloud's composition, he reminded himself. It was hydrogen, but in a concentration that made swift flight suicidal.

"They got this theory," Bingaling had said, "that it's an embryo star like. One day it's just going to go fwoosh and compress down into one star mass."

Deirut read his instruments. He could sense his ship around him like an extension of his own nerves. She was a pinnace class for which he and his fellow pilots had a simple and obscene nickname—two hundred and fifty meters long, crowded from nose to tubes with the equipment for determining if a planet could support human life. In the sleep-freeze compartment directly behind him were the double-checks—two pairs of rhesus monkeys and ten pairs of white mice.

D-ship pilots contended they'd seeded more planets with rhesus monkeys and white mice than they had with humans.

Deirut switched to his stern instruments. One hour into the cloud and already the familiar stars behind him were beginning to fuzz off. He felt the first stirrings of unease; not the push . . . but disquiet.

He crossed his arms, touching the question-mark insignia at his left shoulder. He could feel the ripe green film of corrosion on the brass threads. *I should polish up,* he thought. But he knew he wouldn't. He looked around him at the pilot compartment, seeing unracked food cannisters, a grease smear across the computer console, dirty fatigues wadded under a dolly seat.

It was a sloppy ship.

Deirut knew what was said about him and his fellow pilots back in the top echelons of the D-Service.

"Rogues make the best searchers."

It was an axiom, but the rogues had their drawbacks. They flouted rules, sneered at protocol, ignored timetables, laughed at vector search plans . . . and kept sloppy ships. And when they disappeared—as they often did—the Service could never be sure what had happened or where.

Except that the man had been prevented from returning . . . because there was always the push.

Deirut shook his head. Every thought seemed to come back to the push. He didn't have it yet, he assured himself. Too soon. But the thought was there, aroused. It was the fault of that cloud.

He re-activated the rear scanners. The familiar stars were gone, swallowed in a blanket of nothing-

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ness. Angrily, he turned off the scanner switch.

I've got to keep busy, he thought.

For a time he set himself to composing and refining a new stanza for the endless D-ship ballad: "I Left My Love On Lyra In The Hands Of Gentle Friends." But his mind kept returning to the fact that the stanza might never be heard . . . if his plans succeeded. He wondered then how many such stanzas had been composed never to be heard.

The days went by with an ever-slowing, dragging monotony.

Eighty-one days, he reminded himself time and again. *Bingaling turned back at eighty-one days.*

By the seventy-ninth day he could see why. There was no doubt then that he was feeling the first ungentle suasions of the push. His mind kept searching for logical reasons.

You've done your best. No shame in turning back now. Bingaling's undoubtedly right—it's nothing but cloud all the way through. No stars in here . . . no planets.

But he was certain what the Bu-psych people had done to him and this helped. He watched the forward scanners for the first sign of a glow. And this helped, too. He was still going some place.

The eighty-first day passed.

The eighty-second.

On the eighty-sixth day he began to see a triple glow ahead—like lights through fog; only the fog was black and otherwise empty.

By this time it was taking a conscious effort to keep his hands from straying toward the flip-flop controls that would turn the ship one hundred eighty degrees onto its return track.

Three lights in the emptiness.

Ninety-four days—two days longer than he'd ever withstood the push before—and his ship swam free of the cloud into open space with three stars lined out at a one o'clock angle ahead of him—a distant white-blue giant, a nearby orange dwarf and in the center . . . a lovely golden sol-type to the fifth decimal of comparison.

Feverishly, Deirut activated his mass-anomaly scanners, probing space around the golden-yellow sun.

The push was terrible now, insisting that he turn around. But this was the final convincer for Deirut. If the thing Bu-psych had done to him insisted he go back now, right after discovering three new suns—then there could be only one answer to the question "Why?" They didn't want a D-Service rogue settling down on his own world. The push was a built-in safeguard to make sure the scout returned.

Deirut forced himself to study his instruments.

Presently, the golden star gave up its secret—a single planet with a single moon. He punched for first approximation, watched the results

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stutter off the feedout tape: planetary mass .998421 of Earth norm . . . rotation forty plus standard hours . . . mean orbital distance 243 million kilometers . . . perturbation nine degrees . . . orbital variation thirty-eight plus.

Deirut sat bolt upright with surprise.

Thirty-eight plus! A variation percentage in that range could only mean the mother star had another companion—and a big one. He searched space around the star.

Nothing.

Then he saw it.

At first he thought he'd spotted the drive flare of another ship—an alien. He swallowed, the push momentarily subdued, and did a quick mental review of the alien-space contact routine worked out by Earth's bigdomes and which, so far as anyone knew, had never been put to the test.

The flare grew until it resolved itself into the gaseous glow of another astronomical body circling the golden sun.

Again, Deirut bent to his instruments. My God, how the thing moved! More than forty kilometers per second. Tape began spewing from the feedout: Mass 321.64 . . . rotation nine standard hours . . . mean orbital distance 58 million kilometers . . . perturbation blank (insufficient data) . . .

Deirut shifted to the filtered visual scanners, watched the companion sweep across the face of its star and curve out of sight around the other side. The thing looked oddly familiar, but he knew he could never have seen it before. He wondered if he should activate the computer's vocoder system and talk to it through the speaker embedded in his neck, but the computer annoyed him with its obscene logic.

The astronomical data went into the banks, though, for the experts to whistle and marvel over later.

Deirut shifted his scanners back to the planet. Shadowline measurement gave it an atmosphere that reached fade-off at an altitude of about a hundred and twenty-five kilometers. The radiation index indicated a whopping tropical belt, almost sixty degrees.

With a shock of awareness, Deirut found his hands groping toward the flip-flop controls. He jerked back, trembling. If he once turned the ship over, he knew he wouldn't have the strength of purpose to bring her back around. The push had reached terrifying intensity.

Deirut forced his attention onto the landing problem, began feeding data into the computer for the shortest possible space-to-ground course. The computer offered a few objections "for his own good," but he insisted. Presently, a landing tape appeared and he fed it into the control console, strapped down, kicked the ship onto automatic and sat back perspiring. His hands held a

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death grip on the sides of his crash-pad.

The D-ship began to buck with the first skipping-flat entrance into the planet's atmosphere. The bucking stopped, returned, stopped—was repeated many times. The D-ship's cooling system whined. Hull plates creaked. Darkside, lightside, darkside—they repeated themselves in his viewer. The automatic equipment began reeling out atmospheric data: oxygen 23.9, nitrogen 74.8, argon 0.8, carbon dioxide 0.04 . . . By the time it got into the trace elements, Deirut was gasping with the similarity to the atmosphere of Mother Earth.

The spectrum analyzer produced the datum that the atmosphere was essentially transparent from 3,000 angstroms to 6 X 10^4 angstroms. It was a confirmation and he ignored the instruments when they began producing hydromagnetic data and water vapor impingements. There was only one important fact here: he could breathe the stuff out there.

Instead of filling him with a sense of joyful discovery—as it might have thirty or forty days earlier—this turned on a new spasm of the push. He had to consciously restrain himself from clawing at the instrument panel.

Deirut's teeth began to chatter.

The viewer showed him an island appearing over the horizon. The D-ship swept over it. Deirut gasped at sight of an alabaster ring of tall buildings hugging the curve of a bay. Dots on the water resolved into sailboats as he neared. How oddly familiar it all looked.

Then he was past and headed for a mainland with a low range of hills—more buildings, roads, the patchwork of fenced lands. Then he was over a wide range of prairie with herds of moving animals on it.

Deirut's fingers curled into claws. His skin trembled.

The landing jets cut in and his seat reversed itself. The ship nosed up and the seat adjusted to the new attitude. There came a roaring as the ship lowered itself on its tail jets. The proximity cut-off killed all engines.

The D-ship settled with a slight jolt.

Blue smoke and clouds of whirling ashes lifted past Deirut's scanners from the scorched landing circle. Orange flames swept through dry forage on his right, but the chemical automatics from the ship's nose sent a borate shower onto the fire and extinguished it. Deirut saw the backs of animals fleeing through the smoke haze beyond the fire. Amplification showed them to be four-legged, furred and with tiny flat heads. They ran like bouncing balls.

A tight band of fear cinched on Deirut's chest. This place was too earthlike. His teeth chattered with the unconscious demands of the push.

His instruments informed him they were picking up modulated ra-

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dio signals—FM and AM. A light showing that the Probe-Test-Watch circuits were activated came alive. Computer response circuit telltales began flickering. Abruptly, the P-T-W bell rang, telling him: "Something approaches!"

The viewer showed a self-propelled vehicle rolling over a low hill to the north supported by what appeared to be five monstrous pneumatic bladders. It headed directly toward the D-ship belching pale white smoke from a rear stack with the rhythm of steam power. External microphones picked up the confirming "chuff-chuff-chuff" and his computer announced that it was a double-action engine with sounds that indicated five opposed pairs of pistons.

A five-sided dun brown cab with dark blue-violet windows overhung the front of the thing.

In his fascination with the machine, Deirut almost forgot the wild urge pushing at him from within. The machine pulled up about fifty meters beyond the charred landing circle, extruded a muzzle that belched a puff of smoke at him. The external microphones picked up a loud explosion and the D-ship rocked on its extended tripods.

Deirut clutched the arms of his chair then sprang to the controls of the ship's automatic defenses, poised a hand over the disconnect switch.

The crawling device outside whirled away, headed east toward a herd of the bouncing animals.

Deirut punched the "Warning-Only" button.

A giant gout of earth leaped up ahead of the crawler, brought it to a lurching halt at the brink of a smoking hole. Another gout of earth bounced skyward at the left of the machine; another at the right.

Deirut punched "Standby" on the defense mechanisms, turned to assess the damage. Any new threat from the machine out there and the D-ship's formidable arsenal would blast it out of existence. That was always a step to be avoided, though, and he kept one eye on the screen showing the thing out there. It sat unmoving but still chuffing on the small patch of earth left by the three blast-shots from the ship.

Less than ten seconds later, the computer out-chewed a strip of tape that said the ship's nose section had been blasted open, all proximity detectors destroyed. Deirut was down on this planet until he could make repairs.

Oddly, this eased the pressures of the push within him. It was still there and he could sense it, but the compulsive drive lay temporarily idle as though it, too, had a standby switch.

Deirut returned his attention to the crawler.

The damage had been done, and there was no helping it. A ship could land with its arsenal set on "Destroy," but deciding what needed destruction was a delicate proposition. Wise counsel said you let the

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other side get in a first shot if their technology appeared sufficiently primitive. Otherwise, you might make yourself decidedly unwelcome.

Who'd have thought they'd have a cannon and fire the thing without warning? he asked himself. And the reply stood there accusingly in his mind: *You should've thought of it, stupid. Gunpowder and steampower are almost always concurrent.*

Well, I was too upset by the push, he thought. *Besides, why'd they fire without warning?*

Again, the crawler's cab extruded the cannon muzzle and the cab started to turn to bring the weapon to bear on the ship. A warning blast sent earth cascading into the hole at the left of the crawler. The cab stopped turning.

"That's-a-baby," Deirut said. "Easy does it, fellows. Let's be friends." He flicked a blue switch at the left side of his board. His external microphones damped out as a klaxon sent its bull roar toward the crawler. It was a special sound capable of intimidating almost any creature that heard it. The sound had an astonishing effect on the crawler. A hatch in the middle of the cab popped open and five creatures boiled out of it to stand on the deck of their machine.

Deirut keyed the microphone beside him into the central computer, raised amplification on his view of the five creatures from the machine. He began reading off his own reactions. The human assessment always helped the computer's sensors.

"Humanoid," he said. "Upright tubular bodies about a meter and a half tall with two legs encased in some kind of boot. Sack-like garments belted at the waist. Each has five pouches dangling from the belt. Number five is significant here. Flesh color is pale blue-violet. Two arms; articulation—humanoid, but very long forearm. Wide hands with six fingers; looks like two opposable thumbs, one to each side of the hand. Heads—squarish, domed, covered with what appears to be a dark blue-violet beret. Eyes semi-stalked, yellow and just inside the front *corners* of the head. Those heads are very blocky. I suspect the eyes can be twisted to look behind without turning the head."

The creatures began climbing down off their machine.

Deirut went on with his description: "Large mouth orifice centered beneath the eyes. There appears to be a chin articulation on a short hinge. Orifice lipless, ovoid, no apparent teeth . . . correction: there's a dark line inside that may be the local equivalent. Separate small orifices below each eye stalk —possibly for breathing. One just turned its head. I see a slight indentation centered on the side of the head—purpose unknown. It doesn't appear to be an ear."

The five were advancing on the ship now; Deirut backed off the

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scanner to keep them in view, said: "They carry bows and arrows. That's odd, considering the cannon. Each has a back quiver with . . . five arrows. That five again. Bows slung on the string over left shoulder. Each has a short lance in a back harness, a blue-violet pennant just below the lance head. Some kind of figure on the pennant—looks like an upside down "U" in orange. Same figure repeated on the front of their tunics which are also blue-violet. Blue-violet and five. What's the prognosis?"

Deirut waited for the computer's answer to come to him through the speaker grafted into his neck. Relays clicked and the vocoder whispered through the bones of his head: "Probable religious association with color and number five. Extreme caution is indicated on religious matters. Body armor and hand weapon mandatory."

That's the trouble with computers, Deirut thought. *Too logical.*

The five natives had stopped just outside the fire-blackened landing circle. They raised their arms to the ship, chanted something that sounded like "Toogayala-toogayala-toogayala." The sound came from the oval central orifice.

"We'll toogayala in just a minute," Deirut muttered. He brought out a Borgen machine pistol, donned body armor, aimed two of the ship's bombards directly at the steam wagon and set them on a dead-man switch keyed to a fifteen-second stoppage of his heart. He rigged the stern port to the PTW system, keyed to blow up any unauthorized intruders. Into various pockets he stuffed a lingua pack receptor tuned to his implanted speaker through the computer, a standard contact kit for sampling whatever interested him, a half dozen minigrenades, energy tablets, food analyzer, a throwing knife in a sheath, a miniscanner linked to the ship computer and a slingshot. With a final, grim sensation, he stuffed a medikit under the armor next to his heart.

One more glance around the familiar control center and he slid down the tube to the stern port, opened it and stepped out.

The five natives threw themselves flat on the ground, arms extended toward him.

Deirut took a moment to study them and his surroundings. There was a freshness to the air that even his nose filters could not diminish. It was morning here yet and the sun threw flat light against the low hills and clumps of scrub. They stood out with a clean chiaroscuro dominated by the long blue spear of the ship's shadow wavering across the prairie.

Deirut looked up at his D-ship. She was a red and white striped tower on his side with a gaping hole where the nose should have been. Her number—1107—stenciled in luminous green beneath the nose

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had just escaped the damage area. He returned his attention to the natives.

They remained stretched out on the grass, their stalked eyes stretched out and peering up at him.

"Let's hope you have a good metal-working industry, friends," Deirut said. "Otherwise, I'm going to be an extremely unhappy visitor."

At the sound of his voice, the five grunted in unison: "Toogayala ung-ung."

"Ung-ung?" Deirut asked. "I thought we were going to toogayala." He brought out the linguapack, hung it on his chest with the mike aimed at the natives, moved toward them out of the ship's shadow. As an afterthought, he raised his right hand, palm out and empty in the universal human gesture of peace, but kept his left hand on the Borgen.

"Toogayala!" the five screamed.

His linguapack remained silent. Toogayala and ung-ung were hardly sufficient for breaking down a language.

Deirut took another step toward them.

The five rocked back to their knees and arose, crouching and apparently poised for flight. Five pairs of stalked eyes pointed toward him. Deirut had the curious feeling then that the five appeared familiar. They looked a little like giant grasshoppers that had been crossed with an ape. They looked like bug-eyed monsters from a work of science fantasy he had read in his youth, which he saw as clear evidence that what the imagination of man could conceive, nature could produce.

Deirut took another step toward the natives, said: "Well, let's talk a little, friends. Say something. Make language, huh."

The five backed up two steps. Their feet made a dry rustling sound in the grass.

Deirut swallowed. Their silence was a bit unnerving.

Abruptly, something emitted a buzzing sound. It seemed to come from a native on Deirut's right. The creature clutched for its tunic, gabbled: "s'Chareecha! s'Chareecha!" It pulled a small object from a pocket as the others gathered around.

Deirut tensed, lifted the Borgen.

The natives ignored him to concentrate on the object in the one creature's hands.

"What's doing?" Deirut asked. He felt tense, uneasy. This wasn't going at all the way the books said it should.

The five straightened suddenly and without a backward look, returned to their steam wagon and climbed into the cab.

What test did I fail? Deirut wondered.

Silence settled over the scene.

In the course of becoming a D-ship pilot, Deirut had gained fame for a certain pungency of speech. He paused a moment to practice some of his more famed selections,

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then took stock of his situation—standing here exposed at the foot of the ship while the unpredictable natives remained in their steam wagon. He clambered back through the port, sealed it, and jacked into the local computer outlet for a heart-to-heart conference.

"The buzzing item was likely a timepiece," the computer said. "The creature in possession of it was approximately two millimeters taller than his tallest companion. There are indications this one is the leader of the group."

"Leader schmeader," Deirut said. "What's this toogayala they keep yelling?"

From long association with Deirut, the computer had adopted a response pattern to meet the rhetorical question or the question for which there obviously was no answer. "Tut, tut," it said.

"You sound like my old Aunt Martha," Deirut said. "They screamed that toogayala. It's obviously important."

"When they noted your hand, that is when they raised their voices to the highest decibel level thus far recorded here," the computer said.

"But why?"

"Possible answer," the computer said. "You have five fingers."

"Five," Deirut said. "Five . . . five . . . five . . ."

"We detect only five heavenly bodies here," the computer said. "You have noted that the skies are otherwise devoid of stars. The rapid companion is overhead right now, you know."

"Five." Deirut said.

"This planet," the computer said, "the three hot gaseous and plasma bodies and the other companion to this planet's sun."

Deirut looked at his hand, flexed the fingers.

"They may think you are a deity," the computer said. "They have six fingers; you have five."

"Empty skies except for three suns," Deirut said.

"Do not forget this planet and the other companion," the computer said.

Deirut thought about living on such a planet—no banks of stars across the heavens . . . all that hidden behind the enclosing hydrogen cloud.

He began to tremble unaccountably with an attack of the *push*.

"What'll it take to fix the nose of the ship?" Deirut asked. He tried to still his trembling.

"A sophisticated machine shop and the work of electronics technicians of at least grade five. The repair data is available in my banks."

"What're they doing in that machine?" Deirut demanded. "Why don't they talk?"

"Tut, tut," the computer said.

Thirty-eight minutes later, the natives again emerged from their steam wagon, took up stations standing at the edge of the charred ground.

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Deirut repeated his precautionary measures, went out to join them. He moved slowly, warily, the Borgen ready in his left hand.

The five awaited him this time without retreating. They appeared more relaxed, chattering in low voices among themselves, watching him with those stalked eyes. The word sounds remained pure gibberish to Deirut, but he had the lingua pack trained on them and knew the computer would have the language in a matter of time.

Deirut stopped about eight paces from the natives, said: "Glad to see you, boys. Have a nice nap in your car?"

The tallest one nodded, said: "What's doing?"

Deirut gaped, speechless.

A native on the left said: "Let's hope you have a good metal-working industry, friends. Otherwise, I'm going to be an extremely unhappy visitor."

The tallest one said: "Glad to see you, boys. Have a nice nap in your car?"

"They're mimicking me!" Deirut gasped.

"Confirmed," the computer said.

Deirut overcame an urge to laugh, said: "You're the crummiest looking herd of no-good animals I ever saw. It's a wonder your mothers could stand the sight of you."

The tall native repeated it for him without an error.

"Reference to mothers cannot be accepted at this time," the computer said. "Local propagation customs unknown. There are indications these may be part vegetable—part animal."

"Oh, shut up," Deirut said.

"Oh, shut up," said a native on his left.

"Suggest silence on your part," the computer said. "They are displaying signs of trying to break down your language. Better we get their language, reveal less of ourselves."

Deirut saw the wisdom in it, spoke subvocally for the speaker in his throat: "You're so right."

He clamped his lips into a thin line, stared at the natives. Silence dragged on and on.

Presently, the tall one said: "Augroop somilican."

"Toogayala," said the one on the left.

"Cardinal number," the computer said. "Probable position five. Hold up your five fingers and say toogayala."

Deirut obeyed.

"Toogayala, toogayala," the natives agreed. One detached himself, went to the steam wagon and returned with a black metal figurine about half a meter tall, extended it toward Deirut.

Cautiously, Deirut moved forward, accepted the thing. It felt heavy and cold in his hand. It was a beautifully stylized figure of one of the natives, the eye stalks drooping into inverted U-shapes, mouth open.

Deirut brought out his contact

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kit, pressed it against the metal. The kit went "ping" as it took a sample.

The natives stared at him.

"Iron-magnesium-nickel alloy," the computer said. "Figure achieved by casting. Approximate age of figure, twenty-five million standard years."

Deirut felt his throat go dry. He spoke subvocally: "That can't be!"

"Dating accurate to plus or minus six thousand years," the computer said. "You will note the figures carved on the casting. The inverted U on the chest is probably the figure five. Beneath that is writing. Pattern too consistent for different interpretation."

"Civilization for twenty-five million years," Deirut said.

"Plus or minus six thousand years," the computer said.

Again, Deirut felt a surge of the *push*, fought it down. He wanted to return to the crippled ship, flee this place in spite of the dangers. His knees shook.

The native who had given him the figurine, stepped forward, reclaimed it. "Toogayala," the native said. It pointed to the inverted U on the figure and then to the symbol on its own chest.

"But they only have a steam engine," Deirut protested.

"Very sophisticated steam engine," the computer said. "Cannon is retractable, gyroscopically mounted, self-tracking."

"They can fix the ship!" Deirut said.

"If they will," the computer said.

The tall native stepped forward now, touched a finger to the lingua pack, said: "s'Chareecha" with a falling inflection. Deirut watched the hand carefully. It was six-fingered, definitely, the skin a mauve-blue. The fingers were horn-tipped and double-knuckled.

"Try ung-ung," the computer suggested.

"Ung-ung," Deirut said.

The tall one jumped backward and all five sent their eye stalks peering toward the sky. They set up an excited chattering among themselves in which Deirut caught several repeated sounds: "Yaubron . . . s'Chareecha . . . Autoga . . . Sreese-sreese . . ."

"We have an approximation for entry now," the computer said. "The tall one is called Autoga. Address him by name."

"Autoga," Deirut said.

The tall one turned, tipped his eye stalks toward Deirut.

"Say *Ai-Yaubron ung sreese s'Chareecha,*" the computer said.

Deirut obeyed.

The natives faced each other, returned their attention to Deirut. Presently, they began grunting almost uncontrollably. Autoga sat down on the ground, pounded it with his hands, all the while keeping up the grunting.

"What the devil?" Deirut said.

"They're laughing," the computer said. "Go sit beside Autoga."

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"On the ground?" Deirut asked.

"Yes."

"Is it safe?"

"Of course."

"Why're they laughing?"

"They're laughing at themselves. You tricked them, made them jump. This is definitely laughter."

Hesitantly, Deirut moved to Autoga's side, sat down.

Autoga stopped grunting, put a hand on Deirut's shoulder, spoke to his companions. With a millisecond delay, the computer began translating: "This god-self-creation is a good Joe, boys. His accent is lousy, but he has a sense of humor."

"Are you sure of that translation?" Deirut asked.

"Reasonably so," the computer said. "Without greater morphological grounding, a cultural investigation in depth and series comparisons of vocal evolution, you get only a gross literal approximation, of course. We'll refine it while we go along. We're ready to put your subvocals through the lingua pack."

"Let's talk," Deirut said.

Out of the lingua pack on his chest came a series of sounds approximating "Ai-ing-eeya."

Computer translation of Autoga's reply was: "That's a good idea. It's open sky."

Deirut shook his head. It didn't sound right. Open sky?

"Sorry we damaged your vehicle," Autoga said. "We thought you were one of our youths playing with danger."

Deirut swallowed. "You thought my ship . . . you people can make ships of this kind?"

"Oh, we made a few about ten million *klurch* ago," Autoga said.

"It was at least fifteen million *klurch,*" said the wrinkle-faced native on Deirut's left.

"Now, Choon, there you go exaggerating again," Autoga said. He looked at Deirut. "You'll have to forgive Choon. He wants everything to be bigger, better and greater than it is."

"What's a klurch?" Deirut asked.

The computer answered for his ears alone: "Probable answer—the local year, about one and one-third standards."

"I'm glad you decided to be peaceful," Deirut said.

The lingua pack rendered this into a variety of sounds and the natives stared at Deirut's chest.

"He is speaking from his chest," Choon said.

Autoga looked up at the ship. "There are more of you?"

"Don't answer that," the computer said. "Suggest the ship is a source of mystical powers."

Deirut digested this, shook his head. Stupid computer! "These are sharp cookies," he said speaking aloud.

"What a delightful arrangement of noises," Autoga said. "Do it again."

"You thought I was one of your youths," Deirut said. "Now who do you think I am?"

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The lingua pack remained silent. His ear speaker said: "Suggest that question not be asked."

"Ask it!" Deirut said.

A gabble of sound came from the lingua pack.

"We debated that during the presence of s'Chareecha," Autoga said. "We hid in the purple darkness, you understand, because we have no wish to seed under the influence of s'Chareecha. A majority among us decided you are the personification of our design for a deity. I dissented. My thought is that you are an unknown, although I grant you temporarily the majority title."

Deirut wet his lips with his tongue.

"He has five fingers," Choon said.

"This was the argument you used to convince Tura and Lecky," Autoga said: "This argument still doesn't answer Spispi's objection that the five fingers could be the product of genetic manipulation or that plus amputation."

"But the eyes," Choon said. "Who could conceive of such eyes? Not in our wildest imaginations . . ."

"Perhaps you offend our visitor," Autoga said. He glanced at Deirut, the stalked eyes bending outward quizzically.

"And the articulation of the legs and arms," one of the other natives ventured.

"You're repeating old arguments, Tura," Autoga said.

Deirut suddenly had a picture of himself as he must appear to these natives. Their eyes had obvious advantages over his. He had seen them look behind themselves without turning their heads. The double thumb arrangement looked useful. They must think one thumb an odd limitation. He began to chuckle.

"What is this noise?" Autoga asked.

"I'm laughing," Deirut said.

"I will render that: 'I'm laughing at myself,'" the computer said. Sounds issued from the lingua pack.

"A person who can laugh at himself has taken a major step toward the highest civilization," Autoga said. "No offense intended."

"The theories of Picheck that the concerted wish for a deity must produce same are here demonstrated," Choon said. "It's not quite the shape of entity I had envisioned, however, but we . . ."

"Why don't we inquire?" Autoga asked and turned to Deirut. "Are you a deity?"

"I'm a mortal human being, nothing more," Deirut said.

The lingua pack remained silent.

"Translate that!" Deirut blared.

The computer spoke for him alone: "The experience, training and memory banks available suggest that it would be safer for you to pose as a deity. Their natural awe would enable you to . . ."

"We're not going to fool these characters for five minutes," Deirut said. "They've built spaceships. They have advanced electronic

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techniques. You heard their radio. They've had a civilization for more than twenty-five million years." He paused. "Haven't they?"

"Definitely. The cast figure was an advanced form and technique."

"Then translate my words!"

Deirut grew conscious that he had been speaking aloud and the natives were following his words and the movements of his mouth with a rapt intensity.

"Translate," Autoga said. "That would be *chtsuyop*, no?"

"You must speak subvocally," the computer said. "They are beginning to break down your language."

"They're doing it in their heads, you stupid pile of electronic junk," Deirut said. "I have to use you! And you think I can pose as a god with these people?"

"I will translate because you command it and my override circuits cannot circumvent your command," the computer said.

"A computer!" Autoga said. "He has a translating computer in his vehicle! How quaint."

"Translate," Deirut said.

Sounds issued from the lingua pack.

"I am vindicated," Autoga said. "And you will note that I did it on nothing more than the design of the vehicle and the cut of his clothing, plus the artifacts, of course."

"This is why you are in command," Choon said. "I suffer your correction and instruction abysmally."

Autoga looked at Deirut. "What will you require other than the repair of your vehicle?"

"Don't you want to know where I'm from?" Deirut asked.

"You are from somewhere," Autoga said. "It has been theorized that other suns and worlds might exist beyond the hydrogen cloud from which we were formed. Your presence suggests this theory is true."

"But . . . but don't you want contact with us . . . trade, exchange ideas?"

"It is now apparent," Autoga said, "that the empty universe theory has been disproved. However, a primitive such as yourself, even you must realize such interchange would be pointless."

"But we . . ."

"We well know that the enclosure of our universe has forced us in upon ourselves," Choon said. "If that's what you were going to say?"

"He was going into boring detail about what he has to offer us," Autoga said. "I suggest we get about doing what has to be done. Spispi, you and Tura take care of the computer in his vehicle. Choon and I will . . ."

"What're you doing?" Deirut asked. He leaped to his feet. At least, he thought he leaped to his feet, but in a moment he grew conscious that he was still sitting on the ground, the five natives facing him, staring.

"They are erasing some of my

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circuits!" the computer wailed. "A magneto-gravitic field encloses me and the . . . aroo, tut-tut, jingle bells, jingle bells."

"This is very interesting," Autoga said presently. "He has made contact with a civilization of our level at some previous time. You will note the residual inhibition against lengthy travel away from his home. We'll make the inhibition stronger this time."

Deirut stared at the chattering natives with a sense of deja vu. The speaker in his neck remained silent. His lingua pack made no sound. He felt movement in his mind like spiders crawling along his nerves.

"Who do you suppose he could've contacted?" Choon asked.

"Not one of our groups, of course," Autoga said. "Before we stay out in the light of s'Chareecha and plant ourselves for the next seeding, we must start a flow of inquiry."

"Who will talk to us about such things?" Choon asked. "We are mere herdsmen."

"Perhaps we should listen more often to the entertainment broadcasts," Spispi said. "Something may have been said."

"We may be simple herdsmen whose inquiry will not go very far," Autoga said, "but this has been an experience to afford us many hours of conversation. Imagine having the empty universe theory refuted!"

Deirut awoke in the control seat of his ship, smelled in the stink of the place his own sweat touched by the chemistry of fear. A glance at the instrument panel showed that he had succumbed to the push and turned ship. He was headed back out of the cloud without having found anything in it.

An odd sadness came over Deirut.

I'll find my planet some day, he thought. *It'll have alabaster buildings and sheltered waters for sailing and long stretches of prairie for game animals.*

The automatic log showed turnaround at ninety-four days.

I stood it longer than Bingaling, he thought.

He remembered the conversation with Bingaling then and the curious reference to a previous attempt at the cloud. *Maybe I did,* he thought. *Maybe I forgot because the push got so tough.*

Presently, his mind turned to thoughts of Capella Base, of going home. Just the thought of it eased the pressures of the push which was still faintly with him. The push . . . the push—it had beaten him again. Next trip out, he decided, he'd head the opposite direction, see what was to be found out there.

Almost idly then Deirut wondered about the push. *Why do we call it the push?* he wondered. *Why don't we call it the pull?*

The question interested him enough to put it to the computer.

"Tut-tut," the computer said. ■

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the reference library

P. Schuyler Miller

SCIENCE FICTION ENCAMPMENT?

As the Ides of February draw near, it appears that we may have been saved from a pretty ugly fate by that darling of the lit'ry Establishment, Truman Capote. His "In Cold Blood" just may have swung the fancy of the "self-elected aristocrats of taste" to the true crime field at a time when they seemed likely to classify science fiction as Camp. This patronage might have helped sales—does the Establishment pay for anything?—but it would more probably have finished us off.

"Camp," originally a homosexual term for "gay" mockery of a "square" world, was injected into the general field of status ranking by the New York critic, Susan Sontag, in an article in the Fall, 1964 *Partisan Review*. Since that time many other writers have attempted their own, often dissenting glossaries and Miss Sontag has added an article on the Campishness of Japanese "science fiction" films in the October, 1965 *Commentary*. I find it interesting to note that she uses the term "sci-fi," which as far as I know was coined by Forrest Ackerman in his monster magazines. It suggests that she has—happily—not encountered "hard" SF, and maybe she never will.

In the liberal application of the term—Miss Sontag is a conservative—something that is "Camp" is so bad that it is good. A soup can label, the original "Batman" fifteen-part serial—now being shown in one sitting of over four hours—Tiffany lampshades, the style of lettering used on popular magazine covers in the 1920's, summer-report souvenir pillows—these are Unintentional Camp. A Pop Art painting of the soup can, the present "Batman" TV programs, the same lettering on present book jackets—these are Intentional Camp, and I gather that Miss Sontag, a purist, would not accept them as true Camp. That, in her original defini-

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tion, must be taken seriously by its practitioners and the audiences for whom it is produced. It must be bizarre, exaggerated, unreal, extravagant . . . and totally ridiculous by the standards of the present style-setters.

It seems to me that science fiction, taken as a whole, does satisfy Miss Sontag's criteria of extravagance and seriousness. With "Flash Gordon" and "Rodan" firmly encamped, imagine what would have happened if the taste-makers had ever discovered Captain Future or the Lensmen!

It also seems to me that, in spite of all their protestations, the Camp followers are merely exploiting another facet of the attitude which has produced the "theater of the absurd," the "underground" films, the "Happenings". These make no sense because their authors and patrons hold that there is no sense in the world. This is, of course, the antithesis of the attitude which produces science fiction . . . but to an academically oriented intellectual the whole of science *is* totally meaningless, and so are the concepts of science fiction.

There's another element in Camp itself. From my square corner there is a pretty evident parallel between their condescending patronage of the Camp and the attitude with which monarchs used to employ freaks and idiots as jesters, or hold salons in insane asylums. This we may not have escaped. The French film, "Alphaville" —which I haven't seen—sounds like an Intentional Camp parody of the science fiction form. "The Tenth Victim" certainly is, but it retains a little of Robert Sheckley's touch. The French "sex and science fiction" comic strip, "Barbarella," will be published this spring as a $5.95 book and made into a Jane Fonda film, and William Burroughs is continuing to use his Nova Police in his new book, "The Soft Machine." There is also to be a "new wave" production of Ray Bradbury's "Fahrenheit 451."

These parody science fiction themes—which is something we have never hesitated to do ourselves. But we would base our parody on the premise that the themes are serious; the Camp approach is that only an ignorant, tasteless imbecile could take them seriously. This attitude we can do without.

For Convention-Goers

The "convention-without-a-program," the seventeenth annual MidWestCon, will be held on June 24th and 25th at the Carrousel Motel, 8001 Reading Road, Cincinnati, Ohio. This is just a block farther out of town than the North Plaza Motel, where the MidWest was held for so many years. Since Cincinnati, Cleveland and Detroit are the three cities sponsoring the Tricon, over Labor Day weekend, there will undoubtedly be a good deal of informal planning.

If you want to know more, write

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Lou Tabakow, 3953 St. Johns Terrace, Cincinnati, Ohio 45236. No registration fee; program purely informal; activities purely social.

And as a reminder, the *World* Science Fiction Convention will be in Cleveland, Ohio, over the Labor Day weekend. It starts early with informalities September 1st and continues through the 5th. Guest of Honor and dinner speaker, L. Sprague de Camp, who needs no introduction to older readers of this magazine.

Membership dues pay the expenses and get you advance announcements; they also entitle you to vote for your choice of the best science fiction/fantasy of 1965. $3.00 if you're attending: $2.00 if you just want to keep in touch: to William Thailing, Treasurer, 24th World Science Fiction Convention, P.O. Box 1372, Cleveland, Ohio 44103.

THE FORGOTTEN PLANET
By George Henry Smith • Avalon Books, New York • 1965 • 189 pp. • $3.25

No, Virginia, this isn't the "Forgotten Planet" that was turned into such a good film, nor is it a book written from the script. A new author in the Avalon stable has done an original that offers a change in pace from their condensations of "classics" whose copyright has expired. It's in the Poul Anderson-H. Beam Piper-Gordon Dickson vein of future history in the shambles of a former galactic empire, but not as well done. Back when a new issue of a new SF magazine appeared every Thursday, it would have made a good "complete novel."

Earth has long since abandoned its empire among the stars and withdrawn to contemplate its collective navel. Relict societies on the former colonial planets are struggling along as best they can. On Nestrond, the bookish Prince Basil of Bradmore is rather clumsily trying to set himself on the planetary throne to which his mother considers him the heir. Smashed in a hopeless battle, he is rescued by one of the Golandians, a race of worldless interplanetary traders. He presently finds them his allies—and himself their tool.

Formula? Yes, but Basil is more fallible than the formula hero of such a story, and thereby more interesting. The reader learns with him. Call it second or third rank on the Avalon scale, which doesn't overlap more ambitious publishers' offerings very much.

THE JOHN WYNDHAM OMNIBUS
Simon and Schuster • New York • 1965 • 532 pp. • $5.95

Simon and Schuster, once known as a daring and discerning publisher, has been playing it safe in science fiction for far too long. The last really outstanding original book they published, as far as I can recall, was Jack Williamson's "The Humanoids." Now they are playing

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safe again by bringing out an omnibus of three reprint novels: John Wyndham's "The Day of the Triffids," "The Kraken Wakes" (called "Out of the Deeps" when Ballantine published the simultaneous hard and soft-cover editions in 1953), and "The Chrysalids" ("Rebirth" in the 1955 Ballantine simultaneous editions).

If you haven't read these stories, you should. Wyndham, with Arthur C. Clarke, was one of the first writers to suggest that England had by no means let the tradition of H. G. Wells languish and was willing and able to take the play back from the U.S.-dominated era of the Depression and war years. He's been quiet lately, or doing other things under other names. Since the original English names of the two later books are used, this may be an American reprint of an English omnibus. (More lack of initiative at S&S.)

"Day of the Triffids" needs no introduction now, since the English film version of a few years ago is going the rounds on TV. (It played the drive-ins here and I didn't see it.) In it, plants from outer space take over the Earth, or try to, quite as convincingly as Wells' Martians. In "The Kraken Wakes" the invaders attacked from the sea. "The Chrysalids," by contrast, is the story of an outlawed mutant in the world recovering from an atomic war. This is probably the rare one, for the paper used in both Ballantine editions was so poor that it is brown and crumbling, in contrast to the older "Out of the Deeps." At any rate, most people don't know about it. Here's your chance to find out what it's like.

THE RAGGED EDGE

By John Christopher • Simon and Schuster • New York • 1965 • 254 pp. • $4.50

During what Sprague de Camp likes to designate as "Hitler's War" there was a G. I. joke which suggested that if the barrage balloons over England were to burst, the island would sink into the Atlantic. I don't know whether the English people do have an inherent fear that their piece of rock and grass will vanish overnight, but English science-fiction writers certainly have a peculiar talent for convincing stories of world cataclysm, seen from a microcosmic point of view. This book is an excellent example by an excellent practitioner who has been in the doldrums for a while.

In this story the Earth, for reasons which the author doesn't bother to rationalize, since his narrator probably wouldn't bother either, begins what is apparently a new cycle of mountain building. Tremendous earthquakes shake the globe, including portions that had believed themselves safe from such things. In the final cataclysm, the seabed of the northeastern Atlantic is raised and the ocean drains away, leaving England once more part of the conti-

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nent as it was until some ten thousand years ago.

Matthew Cotter, the narrator, is a market gardener on Guernsey, one of the islands in the English Channel, off the French coast, where various breeds of highly efficient cattle and some of my own ancestors originated. He lends a hand with the salvaging of people and food, dislikes the nature of the community that is forming, and slips away across the drained seabed in an attempt to find his daughter in England.

This trek across the bottom of what was once the English Channel is the most fascinating part of the book, but it is underplayed in the author's typical manner. There are no krakens or sea serpents in the remaining pools, no ruins of Atlantis or Ys, but there are the wrecks of centuries and a well-found modern ship sitting securely on the bottom with a mad seaman keeping everything shipshape.

In England, Cotter and the young boy whom he has taken in tow come up against refugee communities of other kinds, and join one of them for a time. What has happened to human society is predictable from other stories of the kind, and after a session of jury duty a couple of years ago, I am willing to say that it is realistic. The intellectual dogma that people just do not act like the stereotypes of popular fiction and the soap operas is pure poppycock. It shows only that the aforesaid intellectuals, in spite of any predilection for boards and sandals, keep themselves safely aloof from the "masses" who do find in TV an idealized mirror of their own lives and aspirations.

This is John Christopher back in the vein of "No Blade of Grass," and I hope it means that Simon & Schuster are getting out of the doldrums.

OF TIME AND SPACE AND OTHER THINGS

By Isaac Asimov • Doubleday & Co. • Garden City, N.Y. • 1965 • 204 pp • $4.50

By this time, nobody should have to recommend one of Isaac Asimov's collections of his science articles from *Fantasy & Science Fiction*. Their content is predictable in being unpredictable, and even in the most familiar subjects the good doctor manages to find something new and strange.

The seventeen essays in this volume—still a prime number of prime articles, you note—are mostly astronomical. I prefer the smaller section on "Other Things," such as the contents of Pike's *Arithmetic* of 1797, the surprising constant that seems to govern the longevity of most animals except man—a billion heartbeats—the minor advantages of Roman numerals—the old-fashioned kind, that is, before the subtractive principle was used, and why the inert gases aren't inert any longer.

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True, in the astronomical section are such tidbits as a justification for the conclusion, "I am, therefore the universe expands," and why the Moon is too far away. If the answers to these do not seem immediately apparent, ask Dr. Asimov.

EDGAR RICE BURROUGHS: MASTER OF ADVENTURE

By Richard A. Lupoff • Canaveral Press, New York • 1965 • 296 pp. • $7.50.

This is a perplexing book that will be required reading for Burroughs fans and may be anathema to Burroughs haters. It is not—and the author never intended it to be —a full-scale biography of Edgar Rice Burroughs. It would be more accurate to call it a biography of his writing.

Richard Lupoff is the New York fan and fanzine publisher who became Canaveral's fiction editor when that subsidiary of an antiquarian bookseller undertook to bring hardback editions of the best Burroughs books back into print, and to publish some of the uncollected and posthumous stories of Tarzan, John Carter, Carson Napier, et al. He was a student of Burroughs' books before he, so to speak, fell into the jackpot of unpublished manuscripts and personal papers. This bibliobiography is the handsomest of the Canaveral books, and is liberally illustrated with drawings by various artists, done for the book or intended for Burroughs reprints that may have been dropped.

Anyone reading one or two of Edgar Rice Burroughs' fantastic adventure yarns would be bound to consider him an uncomplicated product of his times and their tastes. But reading a good deal of Burroughs changes the picture. Somebody who knew him, or who can talk with people who knew him, could and should do a full-scale biography that will show what forces in Burroughs' early life made him write the kind of books he did, and how his attitudes changed as he grew older and began to experiment a little. Dick Lupoff points to some of this: for example, the glorification of war as a manly pursuit in the early books, and the gradual shift to the satirization of the final stories. Unfortunately, he had no opportunity to do more.

We have, mainly, a running chronicle of Burroughs' writing career, shown against the popular magazine fiction of the early and middle twentieth century, of which it was a part and of which magazines like Analog are survivors. The author is no idolator, but he has rather effectively suggested some of the elements that make Tarzan and John Carter more memorable than the heroes of stories by more accomplished writers, published at the same time. Some legends are shown to be myths: Burroughs never pretended, for example, that he

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did not owe a great debt to Kipling's "Jungle Books" in his shaping of Tarzan. The principal books are outlined in considerable detail, so that long sections read like a running synopsis—but it is a synopsis with running, 1965-oriented commentary. I enjoyed reading it—rather, reading around in it, which you can do quite easily. But I'd still like to see someone do that real biography, and so, I am sure, would Richard Lupoff. He'd probably do his best to get Canaveral to publish it.

SCIENCE FICTION TITLE CHANGES

By Michael Viggiano and Donald Franson • Donald L. Franson • 6543 Babcock Ave., North Hollywood, California 91606 • 1965 • 47 pp. • $1.00

This is one of those bibliographical aids compiled and published by fans that I harp on from time to time. There are a good many more that I don't see, but hear about long after they've gone out of print and are bringing fancy prices from rare book dealers. This is one of the publications of the "N3F," the National Fantasy Fan Federation, which aren't ordinarily offered for sale—merely circulated among its members. It seems to represent the pooling of work by several people.

In this department I try, as well as a very faulty memory permits, to track down the original publication of allegedly "new" stories which you may have read in a previous incarnation. This pamphlet, well litho printed in 5½ by 8½-inch format will help in that. It attempts to list all the titles under which a given story has appeared, and when several short stories and novelettes are combined into a book, as in Bradbury's "Martian Chronicles," gives the full list. Unfortunately—though for obvious practical reasons it would have been too much of a job—the cross-title index is all that's here: where the stories were published under their various names is not specified. For that, you have to refer to one of the other fan bibliographies.

The publisher will welcome additions and corrections as much as he will sales. Go thou and help out, if you can.

MOSTLY REISSUES

A CLOCKWORK ORANGE

By Anthony Burgess • Ballantine Books, New York • No. U-5032 • 191 pp. • 50¢

Ballantine evidently doesn't consider this science fiction; at least, they didn't send it with their usual review books. For all that, it's a modern classic that makes "Brave New World" seem tepid. It shows a future England in which the teenage gangs have dominated and shaped the society in a grim way. It is written in a jargon that is explained in an appendix to this edition, as it was in the "class" paper-

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back of which this is a reprint. You'll find it hard to like, but it's unforgettable.

OUT OF THE SILENT PLANET
By C. S. Lewis • Collier Books, New York • No. AS-207V • 160 pp • 95¢

OUT OF THE SILENT PLANET
By C. S. Lewis • Macmillan Paperbacks, N.Y. • 160 pp. • 95¢

PERELANDRA
By C. S. Lewis • Macmillan Paperbacks, N.Y. • 222 pp. • 95¢

More confusion for bibliographers. Macmillan published the American hardback editions of Lewis' mystical interplanetary trilogy. In 1962 Collier Books began issuing paperback editions, and this reissue of the first of the series appeared with a new cover last fall. Meanwhile, Collier bought Macmillan, and almost simultaneously a new set of paperback reprints, apparently printed from the same plates but with different title pages and showy new covers, began to appear under the Macmillan imprint. The third volume, "That Hideous Strength," is supposed to be available in both series, but Pittsburgh bookstores haven't seen it.

LEVEL 7
By Mordecai Roshwald • Signet Books, New York • No. D-2659 • 143 pp. • 50¢

Reissue of the novel about a society that has buried itself to escape the consequences of nuclear war.

THE BLACK STAR PASSES
By John W. Campbell • Ace Books, New York • No. F-346 • 223 pp. • 40¢

THE MIGHTIEST MACHINE
By John W. Campbell • Ace Books, New York • No. F-364 • 220 pp. • 40¢

Here Ace launches paperback editions of two of John Campbell's earliest series: the Arcot, Wade, Morey series with "The Black Star" and the Aarn Munro series with "Mightiest Machine." The original magazine versions date back to the 1930's. Here John picked up the baton that "Doc" Smith had waved with his "Skylark of Space" and was out of sight in no time. A little later John himself, in disguise as "Don A. Stuart," induced the imago to hatch out of this stage of SF.

FARNHAM'S FREEHOLD
By Robert A. Heinlein • Signet Books, New York • No. T-2704 • 256 pp. • 75¢

The paperback of Heinlein's last novel, as infuriating, fascinating and unsatisfactory as his latest books have been. Farnham is as detestable a hero as we've had lately, but you can't deny that he has and exemplifies a serious philosophy.

GALACTIC CLUSTER
By James Blish • Signet Books, New York • No. D-2790 • 176 pp. • 50¢

Reissue of the 1959 short-story collection, all good.

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THE GREAT TIME MACHINE HOAX

By Keith Laumer • Pocket Books, New York • No. 50156 • 176 pp. • 50¢

"A science fiction romp" the cover says. It's right.

THE TWILIGHT ZONE

By Rod Serling • Tempo Books, Grosset & Dunlap, N.Y. • No. T-89 • 190 pp. • 50¢

NEW STORIES FROM THE TWILIGHT ZONE

By Rod Serling • Bantam Pathfinder Editions, New York • No. EP-121 • 122 pp. • 45¢

Both of these editions of stories based on Serling's popular TV series are evidently intended for teenagers. In the Tempo Books edition, the stories—harmless enough as I remember Serling's originals—are "adapted by Walter B. Gibson." They are mainly ghost stories. The new Bantam edition is a reissue of the 1962 paperback in which Serling tells his own stories, including some SF.

THE SIEGE OF HARLEM

By Warren Miller • Crest Books, Greenwich, Conn. • R-833 • 128 pp. • 60¢

The author of the unique "Looking for the General" lampoons his friends in Harlem with this "Uncle Remus" fable of the time Harlem seceded from the Union and became the first black nation of North America.

THE HOUSE THAT STOOD STILL

By A. E. van Vogt • Paperback Library, New York • No. 52-873 • 159 pp. • 50¢

Some of van Vogt's "classics" irk me on rereading. This one, for some reason, grows on me.

A JOURNEY TO THE CENTER OF THE EARTH

By Jules Verne • Airmont Publishing Co., New York • No. CL60 • 192 pp. • 50¢

Verne's most readable SF book in Airmont's teen-age paperback series, with a cover that has no faintest connection with the book—men in spacesuits, exotic machines—and an excellent introduction by old fan and present editor Robert A. W. Lowndes.

THE FOOD OF THE GODS

By H. G. Wells • Airmont Publishing Co., N.Y. • No. CL59 • 190 pp. • 50¢

And Wells, too—this time with an introduction by Donald A. Wollheim. A good place for the kids to begin, and respectable enough for teachers and school librarians.

ODD JOHN

By Olaf Stapledon • Berkley Books, New York • No. F-1126 • 191 pp. • 50¢

There have been other paperbacks of Stapledon's superman classic, at least in England. It's still great.

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brass tacks brass tac

Gentlemen:

Apropos of "In Times to Come" wherein you say, "The cover's a dilly—it's a shame it isn't economically possible to print it up without type."

I find that many of your covers —and illos, too—especially by Schoenherr, or Freas, are dillies I'd pay for—especially if they could be blown to, maybe? double? or triple? size? In color? Or black and white? Would you? For a dollar? Could you, for two? Or fifty cents?

Why not discuss it in print, with the, er, membership.

R. S. Huntman
360 West 55 St. (2S)
New York, N. Y.

Color plates are very expensive. Our present size cost about $800; double-size would be about $3,000. Good photographic color prints, 8 x 10 size, cost about $12 each; bad ones are cheaper, of course, but why bother?

Dear John:

Just got back from Chesley Bonestell's place. He's done a lovely cover of the galaxy seen from a planet in intergalactic space. (The exact distance depends on the diameter assumed for the galaxy; as you know, Hoyle has lately questioned the usual 100,000 light-year figure, and estimates it at more like 60,000. However, we decided to stick with the more orthodox value, which puts us about 230,000 1-y out.) As for my part of the project, I'll be rewriting the manuscript now, and you should have it inside a couple of weeks. Hope you like it—I know you'll like the cover, anyhow!

One point came up which may interest you. Though the galaxy would be a huge object in the sky, covering some 20° of arc, it would not be bright. In fact, I make its luminosity, as far as this planet is concerned, somewhere between 1% and 0.1% of the total sky-glow (stars, zodiacal light, and permanent aurora) on a clear moonless Earth night. Sure, there are a lot of stars there—but they're an awfully long ways off!

Bonestell's picture does show a glowing object, but this is no contradiction to the text. For one thing, the planet has no sky-glow of its own (for reasons given in the

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story), so that you would get more contrast and thus the galaxy looks brighter. For another thing, there are natives, adapted to the dim light of a red dwarf sun, and to them the galaxy would most certainly appear quite luminous.

To us, galaxies look brilliant in an astronomical photograph—but that picture involved a huge light-gathering mechanism plus hours of exposure. We could make the Milky Way look just as bright if we wanted to.

The point has no special importance. I mention it only because it surprised me. One tends to take a lot of things for granted until one actually calculates the matter out. I thought it would amuse you, too.

Poul Anderson

Dear Mr. Campbell:

Reference the letter of William A. Lewis, Jr., in the January, 1966, issue, Orwell is translating Ecclesiastes 9:11. "I returned, and saw under the sun, that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to the understanding, nor yet favor to men of skill; but time and chance happeneth to them all."

Funny as it is, Orwell's translation is by no means labored or unrealistic; I think of it every time I have to read over a Federal Government form that I couldn't untangle the first time through. Also, certain academic disciplines would vanish from the face of the earth without their stock of obscure and/or meaningless polysyllables.

Edward L. Dreyer
10 Line St.
Somerville, Mass. 02143

How to tell the In Group from the Unimportant Clods! Can they read our gobbledygook?

Dear Mr. Campbell:

I must disagree with the letter in your January issue from Wallace West. Unfortunately, he has his facts wrong.

He is correct that neither English Common Law nor International Law sets any procedure for claiming space. But it should be underlined that attempts have been made using both and the reason that they fail is that they just weren't designed to do the job. In this sense, it is a mistake to use the analogy from Grotius. All too many people have tried to extend Grotius to outer space only to find that our space and his oceans are two entirely different physical media.

Legal minds certainly are touchy. Hence, there is no accepted phrase at all. The Russians can not, in fact, claim the area Mr. West thinks they can. He forgets that they were the first ones into space and therefore had the rather unenviable task of setting forth the first tentative definitions of space. The official line is that their first sputnik and our present efforts do not violate anybody's air space because these objects are

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fixed in space. It seems that the earth revolved under them.

Law, we are realizing, has to have some real connection to the physical media it deals with and so space, in the end, may just have to be left absolutely free.

BRUCE HENSTELL
1424 Grove Street
Berkeley, California 94709

Maybe that's because there's nothing to it?

Dear Mr. Campbell:

The letter of William A. Lewis, Jr., in the Brass Tacks column of the January, 1966, issue of Analog caught my eye soon after I bought the issue just a short while ago. As an example of tortured English prose, he quotes George Orwell's tongue-in-cheek paraphrase of a Biblical quote:

"Objective consideration of contemporary phenomena compels the conclusion that success or failure in competitive activities exhibits no tendency to be commensurate with innate capacity, but that a considerable element of the unpredictable must invariably be taken into account."

Your editorial comment was, "Darned if I can recognize the Biblical passage from that 'translation.' "

Might I suggest that the original of this delightful bit of double talk is Ecclesiastes 9:11? The translation of the Revised Standard Version reads:

"Again I saw that under the sun the race is not to the swift, nor the battle to the strong, nor bread to the wise, nor riches to the intelligent, nor favor to the men of skill; but time and chance happen to them all."

I have an idea that you have been deluged with letters from Bible-reading engineers and from physicists whose hobby is theology and Old Testament studies.

Edward F. Lacy, III
1516 Hawthorne
Houston, Texas 77006

Re the Biblical deluge: Right. I was!

Dear John:

Your editorials continue to hit the nail right on the thumb. This was especially so in the case of "The Nature of Literature" in your October issue, reviving as it did a knock-down-and-drag-'em-out row between the everloving and myself on that very subject.

The quarrel arose over a book from the library which said everloving insisted that I *must* read. Said book was by a certain French man of letters, a darling of the academicians and, according to the blurb on the jacket, his first novel for twenty years. I tried to read the precious work, and was irked almost at once by some quite unnecessary and dreadfully amateurish incursions into fantasy. I flung the volume from me in disgust and said that I was only a common working stiff, but that if *I* took twenty years to

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write a novel it would be *good.* I added a few well chosen words on the subject of intellectual snobs and long-haired critics, and when Susan began a spirited defense of the highbrow writer and his reviewers I said that only a craftsman was qualified to judge craftsmanship, and that the craftsmanship which had aroused my ire was too shoddy to be tolerated in any of the American pulp magazines. And so on, and so on.

Your editorial, however, recalled to mind more than the above mentioned fight. It caused me to remember a friend in England, a schoolmaster with a degree in Arts—from one of the Universities where Art is Art and Science is Science and never the twain shall meet—whose subject was English Literature. This friend, who was qualified to teach English Literature, used to come to me, qualified only as a Master Mariner, for advice on recommended reading of Twentieth Century authors. Furthermore, his only published work was a piece of verse in a very minor magazine, while I already had quite a few short stories to my credit.

All in all, however, I do not think that any college could possibly train students to become successful authors. The modern writer *must* go out into the world to make his living as well as he is able, gaining the experience and meeting the characters that he will use in his stories. After all, Bill Shakespeare had knocked around more than somewhat before he laid quill to paper—as an actor, as an actor-manager and—as some claim, and there seems to be evidence to support the theory—as a crew member of vessels trading to the Mediterranean. And I need hardly mention one of the greatest novelists of them all—Conrad.

A. BERTRAM CHANDLER

I understand Homer knocked around a bit, too . . .

Dear John:

During pre-school years, whenever my parents would occasionally uncover some of my childish peccadilloes, I would implore, "But, how did you find out?" Invariably, the reply was, "Oh, a little bird told me." From these instances I quite naturally acquired considerable awe, and an unconscious expectancy of some sort of revelations from our feathered friends.

Thus, regarding Problem In Thermodynamics—November 1965 Analog—I arranged an interview with a friendly Chickadee, Mr. Pip-Pip, the other day: He assured me that there's nothing mysterious about keeping his less-than-toothpick size toes from freezing while plying from ice-covered branch to sleet encrusted fence wire in a gusty wind during sub-freezing weather. "It's such a natural function," he chirped.

Mr. Pip-Pip then reminded me that various Tibetan ascetics knew and practiced that particular

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art of thermodynamic control of bodily functions under similar conditions; concomitantly, even being able to walk across firey-hot coals . . . "It simply amounts to Mind Over Matter," he continued, "and chemists' test tubes are not likely to produce any comparable antifreeze solution for crass machinery operating in Arctic areas, or on Jupiter's moons, in the foreseeable future." Whereupon Mr. Pip-Pip concluded the interview, flexed his very efficient tiny wings, and darted from his perch on my shoulder.

LEW MACK
617 Rudd Ave.,
Canon City, Colorado. 81212

Mr. Pip-Pip may be wrong! If a bird-brain can do it, why can't the underlying principle be learned by psiontists—if scientists won't—and applied technically?

Dear Sir:

Permit me to call your attention to an article in the 15 October 1965 issue of *Science* (page 367) entitled: "Extrasensory Electroencephalographic Induction between Identical Twins." In brief, an experiment performed by T. D. Duane and Thomas Behrendt of Jefferson Medical College, Philadelphia, has produced evidence of correlation between the alpha rhythms of some pairs of identical twins when only one was evoked.

Also, pertinently, in *Science Digest*—November 1965, the article on E. S. P. includes a statement by Professor Ernest R. Hilgard (page 68): "To demonstrate something highly implausible requires better evidence than to demonstrate something plausible . . ." If I may comment: Such an attitude cannot be construed otherwise than permitting evidence to be discarded as inadequate whenever the Bible, or the Church, or Newton, or Aristotle, or the President, or the judge, or Professor Hilgard indicates the obvious deduction to be implausible and admitting trivial evidence as proof whenever Authority in one of its many disguises considers it plausible. The sole advantage to the scientific method consists of requiring that each fact or conclusion stand only upon its own merit as determined by standardized, objective criteria. Plausibility is only the ephemeral myth used at a particular time and place to explain things which can never be adequately described.

A final note: The scientific method was never intended to support plausibility but to regularize trial-and-error. Using the prejudice of the observer as the only criterion for judging the adequacy of evidence is the most dangerous invention of the Inquisition: it has no place in the scientific method.

Robert P. Kidwell
5249 Wren, Apt. 50
El Paso, Texas 79924

"Plausible" equals "my theory says it's possible." "True" means "it happens." Only experiments are true!

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OBSERVER EFFECT

continued from page 7

can in physics. The unit in psychology is "a mind"; when the unit is of such an extremely high order of complexity, statistical duplication becomes wildly improbable.

Medicine has a similar problem, in that each human individual is so utterly unique that organ transplantation is normally impossible. The unit is "a human being," and the unit is so complex that every individual can—and does—have his own unique biochemistry.

Mind structure is, evidently, even more complex than physiological structure—which has made psychology even more difficult to analyze.

Moreover, the M.D. has the advantage that the physical sciences are able to supply a great deal of help, since whatever the individual's biochemistry may be, it must necessarily be derived from the underlying laws of Biochemistry—from a set of laws of molecular interactions inherent in the Universe, which any living organism *uses;* it doesn't *generate* them. The living organism stems from the Laws of Biochemistry—not the Laws of Biochemistry from living organisms. The structures of bones, the arrangement of tendons and muscles, are all understandable from the laws of mechanics.

The M.D., in other words, has a great deal of help from physical-science specialists who have studied and learned the sometimes-whimsical-seeming laws that he needs to know.

The psychologist, on the other hand, is dealing with a subjective individual—and no one has worked out the laws of Subjectivity. In fact, there's a general impression that Subjectivity is something that *human minds generate,* rather than recognizing that, on the contrary, Subjectivity is something in the Universe which *human minds can apply,* as human bodies apply Chemistry.

In any field, until the fundamental laws are known, the appearance is that Imps, Demons, Gremlins and Trolls are running the show, with a malign and twisted sense of humor. Observed phenomena will be irrational, unrepeatable, contrary to all known natural law (naturally, a new field means dealing with hitherto unknown natural laws) and mentally frustrating in the highest degree. If you think not —take a look at the names of a couple of the important chemical elements—nickel and cobalt. The metallurgists of old had finally learned how to smelt ores to get

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copper. But the imps, trolls, gnomes, kobalds, and nickels were forever playing dirty jokes on them. Leave a steel tool in the copper mine over a Sunday, and the kobalds would play tricks with it—transmute the outside of the tool to pure copper. (Which was, of course, one of the clearest proofs that transmutation was possible, if you could just catch one of those cursed kobalds!)

Even worse, the kobalds—or their cousins, the nickels—would hex good copper ore, and turn the blue-green mineral into something that couldn't be smelted to yield the ruddy metal. It's all the work of those trickster spirits with their perverse, whimsical, irrational behavior.

Sure—eventually chemists got the kobalds out of the *kobald-kupfer* and *nickel-kupfer* by discovering that those ores, smelted in an entirely different way, yielded different metals. But the imps and evil spirits were in there in the early stages, driving good, honest, sensible men to despair.

As of now, the Science of Subjectivity isn't even an Art. It's partially acknowledged by psychology, but only as a non-lawful something that explains the reason that patients willfully, perversely, and irrationally refuse to behave the way the psychologist knows they ought to.

The standard explanation of "spirits" and "demons" lies at the roots of psychology, as it does at the roots of mineralogy, chemistry, medicine, and all our other sciences. Jesus cured the insane by driving out the demons that had controlled them. The Catholic Church has an official ritual for the Exorcism of Demons. In every field, until the underlying laws that make sense of the seemingly perverse irrationality of Reality are discovered—*"Here dwell Demons!"*

When inexplicable—and seemingly wildly erratic—phenomena occur that are not malign, but frustratingly and unpredictably beneficial, then the term "spirits" is used, with suggestions of ghosts of the departed, instead of the term "demons." The somewhat earlier peoples had their "spirits" minor godlings; the Muses of the Greeks, for instance, unpredictably, erratically, and frustratingly sometimes did, but usually didn't, inspire creativity.

When you don't know how something works, and it seems willful, perverse, and whimsical—blame it on "spirits"! During WWII the obnoxious and whimsical spirits that fouled things up for the air forces in particular, were called gremlins.

So since we know nothing about the basic laws of Subjectivity—"It's all done by spirits. You must believe in the spirits; if you don't, they won't come to perform these phenomena." "You must have faith," or "Only prayer can help you." All

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mean the same thing: "There's something I don't understand that sometimes works for some reason and accomplishes something that doesn't happen normally."

The observer effect in any area of subtle phenomena is prominent; apparently in the realm of Subjectivity, it's a sort of x^2 phenomenon. Not only the observer effect, but also the operator effect.

For example, one of the most readily demonstrated subjective phenomena is the use of dowsing rods for pipe locating. (NOT for "water-witching" which seems to be, at the subjective level, about as different as sawing a piece of white pine and sawing a bar of high-alloy tool steel at the mechanical level.) Now the remarkable thing about the pipe-locating trick is that it's definitely a subjective phenomenon —but the variations are so wildly irrational that any physical-science-only orientation would be assured it was pure nonsense.

The pipe-locating dowsing rods are widely used by field-crews for utility companies simply because they work. The Chinese were using compasses for navigation long before anybody knew anything whatever about magnetic fields. (Spirits moved the needle, of course. We call the spirit "magnetic field" today, but it has the same description: An invisible and intangible entity that produces an effect which cannot be explained without it.)

The water department field crew, seeking a leaking water pipe, will walk across the street holding the rods, and the rods will swing when the operator is standing over the water pipe. It doesn't swing when he crosses the gas pipe, the sewer pipe, the telephone conduit, or the steam pipes. The gas company man, however, gets no response at the water, steam, sewer or telephone pipes—but his rods swing at the gas pipes. The sewer department dowser finds sewer pipes, not gas, water or steam pipes.

But, if a contractor is digging a ditch through the area, using a ditching machine, he does not want to tear up any of the pipes. So a pipe-locator goes ahead of the machine, and for him, the rods swing at the gas, the water, the sewer, the steam, and all other pipes.

Conclusion: This response is *not* a physical-science phenomenon. It isn't due to electric, magnetic, or gravitic anomalies. It shows the characteristic that is characteristically NOT a physical phenomenon—volitional selectivity. It finds what you want to find, and not what you don't want.

But herein cometh the really tricky part of it. Various individuals who use the rods routinely in their work have different notions as to what they will do. And each of them can demonstrate-as-an-observational-fact that they do actually behave as he says. Some users of the rods say that they respond to *any* kind of pipe—concrete, transite

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plastic, metal, brick, clay or wood.

Other users of the pipe-locators assert they work only on metal pipes. Or that they'll work on any kind of pipe provided it's a water pipe, but won't work on oil, gas, or electric "pipes." And each claimant can demonstrate that, for him, they do—or don't—precisely as he says.

See—it's the spirits again! Arbitrary, irrational, unpredictable, inconsistent, obfuscating—deliberately confusing.

Subjective phenomena don't directly affect the rods; the operator's mind is what's doing the business. You might define "mind" as "a device capable of transducing subjective energies to objective, physical level, or physical energies to the subjective level." As a piezoelectric crystal can transduce mechanical energy to electrical energy, and vice versa. In each case, one form of energy you can see, the other you can't, but the transducer can couple the two.

One of the things that makes working with subjective phenomena so exasperating is, of course, that *whimsicality effect.* (Like the miners in the old days; perfectly good blue-green copper ore—that happened to be blue-green nickel ore—just whimsically and for no sensible reason wouldn't smelt out.) If Individual A can, often-but-not-always, produce a strange effect, A may say it can be done only under these, thus, and those conditions. That the "spirits" don't like to be watched, or can't stand light or something of the sort. But Individual B, who can also (sometimes) produce the effect says that light and observers don't matter at all, but that it can only be done when the Moon is full, and the Sun is in Scorpio. And—whadaya know! A can do it when the Moon's in any old phase, and the Sun is in any sign whatever, but can *not* do it when there's light present. While B can do it in full light, provided the Moon is full, and the Sun's in Scorpio, but not at any other time.

And ask a psychologist some time how easy it is to get a claustrophobe to be sensible and realize elevators aren't dangerous. Argue with him. Go ahead!

And A can use dowsing rods to locate any kind of pipe, carrying water, gas, oil, or anything—while just as B told you, the rods do not work for anything but metal pipes carrying water.

You're working with a transducer device that is not only a transducer, but has ideas-of-its-own. It's no simple little crystalline structure like a piezoelectric plate; it's got built-in filters, and some of those built-in filters can be real weirdos.

This helps to make researchers into the subjective areas decide to go do something else, where the level of frustration is lower. Studying subjectivity appears to be studying a field in which all the obser-

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vational data is self-denying. When X says it can be done, and does, Y says it can't be done that way, and proves it. So X says that Y doesn't know what he's talking about; that Y's method is nonsense, and doesn't work, and *he* proves *that*. While Y goes on doing it his way.

Moreover, subjectivity is dominated by symbolism—contrary to Korzybski and all other authorities, at the subjective level the map *is* the territory, the symbol *is* the object. Get someone who's been gnawed on by a lion, and you're quite apt to find that the sound-symbol "lion" is an effective blood-pressure changer. The symbol is the object.

Since we're working with the laws of a different level of Reality, phenomena that are nonsense at the Objective level are perfectly rational, predictable and lawful at this other level. It's utter nonsense to say that two objects can occupy the same space at the same time—but it's not "supernatural" or "impossible" either to have two *fields* occupy the same space at the same time. Just because a thing is wild fantasy for one level of Reality doesn't mean it's either fantasy, or supernatural, or even irrational at another level.

But it sure helps to confuse the first efforts to work in that level! It generates a powerful mental-emotional urge to say, "Oh, to hell with it! It doesn't exist! It makes no sense, it's unduplicatable, there's no rationality, and I'll have nothing whatever to do with it!" And thenceforth the individual declares all such phenomena "coincidences."

O.K.—so coincidences, even wild ones, do happen. Fifty years ago the most widely accepted theory of the origin of the Solar System was the stellar-near-collision idea. That a passing star passed so close to the Sun that great chunks of the Sun's matter were torn out and flung into space by the attraction of the passing star. The principal objection raised to this theory at the time was that stars are so small compared to the immense distances between stars that such an encounter could happen only about once in ten billion years.

To which Sir James Jeans and his fellow supporters of the theory replied, "Agreed. And here we are—proving that a remote possibility can happen once in a galaxy!"

It *could* happen—it *could* be a coincidence. There was no way of refuting that argument—just as there's no way of refuting the explanation of clairvoyant visions, or precognition as being coincidence. It *could* happen that way, undoubtedly.

But now that astrophysical research has discovered four planetary systems within a fifteen light-year sphere—I'm afraid Sir James Jeans' answer wouldn't be good enough. One we could accept as a coincidence, with a little gulping and hard swallowing. And even two

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might have been defensible. But four? In one small segment of an immense galaxy? No!

You might, sometime, look up some of the accumulated records of carefully documented coincidences of the subjective order. Whole books of them.

If those are all coincidences—then all the millions of planets in the galaxy are the result of accidental star-collisions.

Try reading some of them with a little translation of terminology. Where they say "spirit," think of the Magical Spirit of the Compass Needle—invisible, intangible, but potent. And also the spirit of Phlogiston. A mistaken terminology, a mistaken theory, doesn't vitiate facts.

However, the final crowning frustration of the subjective realm is this: *the observer can and does vitiate facts.*

Our only observers are human minds—they are the only available transducers. And they transduce what and only what their theory says can be transduced! If the observing mind holds that the Sun must be in Scorpio—it makes no difference that that is of no importance actually; that mind will then transduce only when the Sun is in Scorpio. Q.E.D.

Oh, well—research has faced problems equally annoying before this, and, with patient determination, worked a way around the impossibility. Human eyes were the *only light-transducers* for the first thirty-five hundred years of science, and they refuse to transduce either infrared or ultraviolet, and return the subjectively-modified report that there are colors we call "brown" and "purple," whereas the spectroscope and bolometer show that neither of those exists. Eyes take blue and red, and set up a fantasy called "purple," an hallucination which they don't distinguish from violet.

When we finally do get some understanding of subjectivity, the chances are excellent that subjective-objective transducers other than living minds can be developed—and the chances are that it will then turn out that the human transducers are as limited with respect to the true range of subjectivity as the human eye with respect to the true electromagnetic spectrum. Or human biochemistry with respect to the total range of chemistry. (Human biochemistry can't handle fluorine chemistry at all—any more than human eyes can see X rays.)

But none of this is going to be accomplished, until people start being willing to tackle the frustrations of the most subtle field of Reality Man has ever tried to understand—and have the courage to stand the wild confusion of the world's worst observer effect.

The observer who, literally, makes his theories come true! What he says is true, becomes true!

The Editor.

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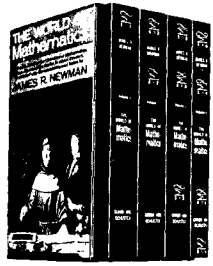

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